EXHIBIT A

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,458	03/27/2024	7924802	63549-396656	8018

199279 7590 10/23/2024

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EXAMINER	
ENGLAND, DAVID E	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
10/23/2024	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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WASHINGTON, DISTRICT OF COLUMBIA 20006

EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,458* .

PATENT UNDER REEXAMINATION *7924802* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

Office Action in Ex Parte Reexamination	**Control No.** 90/019,458	**Patent Under Reexamination** 7924802	
	Examiner DAVID E ENGLAND	**Art Unit** 3992	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

a. ☑ Responsive to the communication(s) filed on 26 March 2024.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ______.

b. ☐ This action is made FINAL.

c. ☐ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire 2 month(s) from the mailing date of this letter.
Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).**
If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Information Disclosure Statement, PTO/SB/08.
3. ☐ Interview Summary, PTO-474.
4. ☐ ______.

Part II SUMMARY OF ACTION

1a. ☑ Claims 1-15 and 17-23 are subject to reexamination.

1b. ☑ Claims 16 and 24-25 are not subject to reexamination.

2. ☐ Claims ______ have been canceled in the present reexamination proceeding.

3. ☐ Claims ______ are patentable and/or confirmed.

4. ☑ Claims 1-15 and 17-23 are rejected.

5. ☐ Claims ______ are objected to.

6. ☐ The drawings, filed on ______ are acceptable.

7. ☐ The proposed drawing correction, filed on ______ has been (7a) ☐ approved (7b) ☐ disapproved.

8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. 119(a)-(d) or (f).

a) ☐ All b) ☐ Some* c) ☐ None of the certified copies have

1 ☐ been received.

2 ☐ not been received.

3 ☐ been filed in Application No. ______.

4 ☐ been filed in reexamination Control No. ______.

5 ☐ been received by the International Bureau in PCT application No. ______.

* See the attached detailed Office action for a list of the certified copies not received.

9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.

10. ☐ Other: ______

cc: Requester (if third party requester)

DETAILED EX PARTE REEXAMINATION NON-FINAL OFFICE ACTION

I. INTRODUCTION

1. This is a Non-Final Office Action on the merits in the *Ex Parte* Reexamination of claims 1 – 15, and 17 – 23 of United States Patent Number 7,924,802 to Tarighat-Mehrabani et al., (hereafter “the ‘802 Patent”). The present application is being examined under the pre-AIA first to invent provisions.

A. References Cited in this Office Action

1. The prior art patents and/or printed publications, hereinafter “the references”, which are listed in form that is similar to a PTO-1449, dated 03/26/2024, have been considered and with the specific reference relied upon in this Office Action, are relisted as follows.

a. U.S. Patent No. 7,742,388 to Shearer et al., (“Shearer’’).

b. U.S. Patent No. 6,516,206 to Jäntti, (“Jäntti”).

c. Rao, K. D., & Murthy, T. S. N. (2007, July). “*Analysis of Effects of Clipping and Filtering on the Performance of MB-OFDM UWB Signals.”* In 2007 15th International Conference on Digital Signal Processing (pp. 559-562). IEEE, “Rao”.

d. U.S. Patent Application Pub. No. 2007/0081613 by Kim et al., (“Kim”).

e. U.S. Patent Application Pub. No. 2005/0237923 by Balakrishnan et al., “Balakrishnan”.

f. U.S. Patent No. 8,416,879 to Rofougaran et al., (“Rofougaran”).

g. U.S. Patent Application Pub. No. 2010/0062726 by Zheng et al., ("Zheng").

h. Declaration of Mark R. Lanning, filed with the Request, (hereinafter "Lanning Dec.").

II. REJECTIONS

A. Relevant Statutes – Claim Rejections

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

1. Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective

filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

B. Detailed Analysis of the Rejection

The Examiner will use the same shorthand notation as the Requester of "1:1-5" for Column 1, lines 1-5.

35 USC § 102

1. Claim(s) 1-4 is/are rejected under pre-AIA 35 U.S.C. 102(a) as being anticipated by Shearer et al. U.S. Patent No. 7,742,388, (hereinafter "Shearer").

RE: Claim 1

A method of transmitting information in a wireless communication channel comprising:

Shearer discloses a method of transmitting information (e.g., infrared (IR) or radio frequency technology) in a wireless communication channel (e.g., IR or RF communication channels in a wireless local network (LAN)), (e.g., Shearer at abstract "Disclosed herein are various embodiments of methods, systems, and apparatus for increasing packet generation in a digital communication system."; 1:31-34, "A wireless local network (LAN) typically uses infrared (IR) or radio frequency (RF) communications channels to communicate between portable or mobile computer terminals and stationary access points or base stations."; 3:61-62, "802.11 is directed to wireless LANs and in particular specifies the MAC and the PHY layers."; 4:62-65, "One embodiment of a transmitter for an 802.11 device is provided in FIG. 3. Referring to FIG. 3, a PHY unit 300 includes an orthogonal frequency division multiplex (OFDM) transmit kernel 320...).

transmitting first information across a first frequency range using a wireless transmitter,

Shearer discloses transmitting first information, (e.g., information transmitted using one 802.11a input signal) across a first frequency range (e.g., the frequency range of down- shifted signal 1000, at about f_c -1.75 MHz to about f_c -18.25 MHz) using a wireless transmitter (e.g., PHY unit 300).

Shearer at FIG. 3 illustrates a wireless transmitter 300:

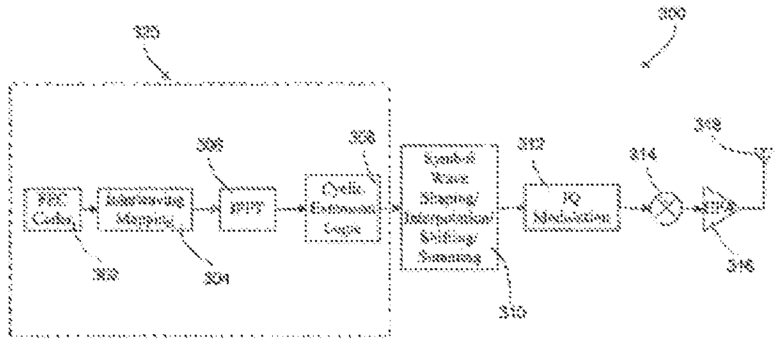


Figure 3

Shearer at col. 5:1-6 ("OFDM transmit kernel 320 includes an FEC coder 302 (for encoding the data received from a MAC unit).... During a data transmit process, data and control information are received at the FEC coder 302."), col. 5:30-33 ("The modulator 312 modulates the encoded data onto carriers in OFDM symbols in accordance with conventional OFDM modulation techniques."). Shearer at col. 8:22-25: "In one embodiment of an 802.11n system, two 20 MHz 802.1 1a input signals are received at the PHY unit 300 from FIG. 3 substantially simultaneously." Shearer at col. 8:25-26: "The two signals are processed separately, one in a lower 20 MHz path and one in an upper 20 MHz path." Thus, one of the "802.11a input signals" includes the "first information" received at the PHY unit (e.g., from a MAC unit). Shearer further discloses that "IEEE 802.11" is a "wireless protocol," (e.g., 1:39 – 40, which is set out in various standards, 1:52- 2:5).

Shearer at FIG. 13 illustrates a system for adding outputs of a low frequency input section 800 and a high frequency input section 1100 of the transmitter 300. See also id. at col. 2:63-64 (FIG. 8 is block diagram of low frequency input section); col. 3:4-5 (FIG. 11 is block diagram of high frequency input section).

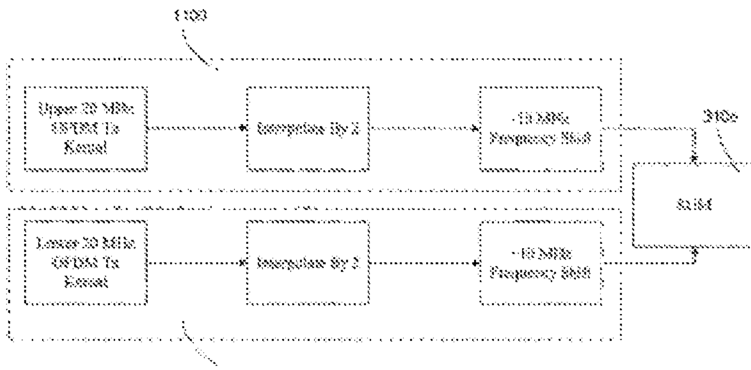
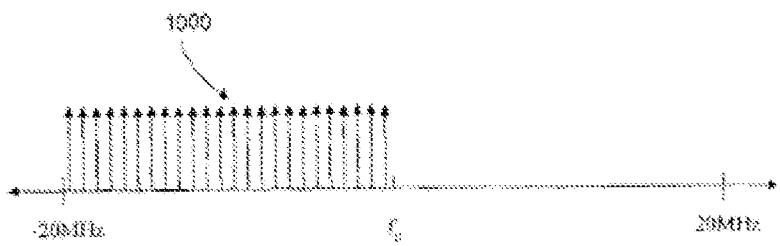


Figure 13

Shearer further discloses that in an example, each input signal has an active frequency range of about 16.5 MHz, less than the nominal 20 MHz channel bandwidth. See, e.g., Shearer at col. 5:43-44. ("In an IEEE 802.11a/g design, each transmission channel has a bandwidth of 20 MHz."), col.5:50-54. (As a "nonlimiting example, there are sixty-four (64) subcarrier bins" and "52 of the bins are populated with non-zero subcarriers."), col. 5:62-64 ("In a 20 MHz packet, the active (populated) subcarriers span a spectrum somewhat less than 20 MHz wide, about 16.5 MHz, in this nonlimiting example."). Note that the exemplary OFDM signal 900 shown in FIG. 9 illustrates the OFDM subcarriers spanning a spectrum somewhat less than 20 MHz wide (i.e., not extending all the way from f_c - 10 MHz to f_c + 10 MHz). As explained in the Lanning Dec., Shearer discloses that each of frequency ranges "is about 16.5 MHz," which is less than the channel spacing of 20 MHz. (See Lanning Dec., ¶¶ 51-53).

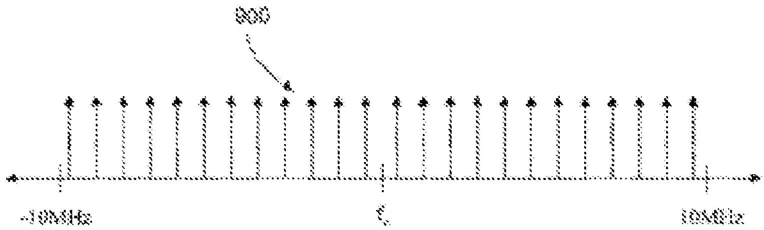
Shearer at col. 8:32-51: "[L]ower 20 MHz OFDM transmit kernel 320a sends the signal to an interpolation stage 310a.... The output of interpolation stage 310a is then shifted down by 10 MHz at frequency shift stage 310b." Shearer FIG. 10 illustrates downshifted signal 1000.



Shearer at col. 5:29-33: "The output of symbol wave shaper/interpolator/shifter/summer 310 is sent to modulator 312. The modulator 312 modulates the encoded data onto carriers in OFDM symbols in accordance with conventional OFDM modulation techniques." Shearer at col. 5:37-42: "The output of the modulator 312 is sent to mixer 314 where it is upconverted to the desired transmit frequency. The upconversion may be performed in multiple mixer stages. From mixer 314, the upconverted signal is amplified in high powered amplifier (HPA) 316 and sent to antenna 318 for transmission." Shearer at col. 5:62-64 ("In a 20 MHz packet, the active (populated) subcarriers span a spectrum somewhat less than 20 MHz wide, about 16.5 MHz, in this nonlimiting example." Thus, the downshifted signal 1000 is transmitted after being upconverted at the mixer to a desired transmit frequency.

the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency; and

Shearer discloses the first frequency range (e.g., the frequency range of down-shifted signal 1000 that is about 16.5 MHZ spanning f_c - 1.75 MHz to f_c -18.25 MHz) having a first center frequency (e.g., f_c - 10 MHz), a first highest frequency (e.g., at about f_c - 1.75 MHz), and a first lowest frequency (e.g., at about f_c - 18.25 MHz). Shearer at col. 8:55-56; "FIG. 9 presents an exemplary 20 MHz 802.11a OFNM signal 900centered at center frequency f_c."



Shearer further discloses that in an example, each input signal has an active frequency range of about 16.5 MHz, less than the nominal 20 MHz channel bandwidth. See, e.g., Shearer at col. 5:43-44. ("In an IEEE 802.11a/g design, each transmission channel has a bandwidth of 20 MHz."), col.5:50-54. (As a "nonlimiting example, there are sixty-four (64) subcarrier bins" and "52 of the bins are populated with non-zero subcarriers."), col. 5:62-64 ("In a 20 MHz packet, the active (populated) subcarriers span a spectrum somewhat less than 20 MHz wide, about 16.5 MHz, in this nonlimiting example."). Note that the exemplary OFDM signal 900 shown in FIG. 9 illustrates the OFDM subcarriers spanning a spectrum somewhat less than 20 MHz wide (i.e., not extending all the way from f_c - 10 MHz to f_c + 10 MHz).

As explained in the Lanning Dec., Shearer discloses that each of frequency ranges "is about 16.5 MHz," which is less than the channel spacing of 20 MHz. (See Lanning Dec., EX1003 ¶¶ 51-53.). As also seen in the Lanning Dec., they have supplied annotations to show how the frequencies would be categorized as stated in the claim.

Claim Term	Notation
First frequency range	$f1_{range}$
First center frequency	$f1_c$
First highest frequency	$f1_{high}$
First lowest frequency	$f1_{low}$
Second frequency range	$f2_{range}$
Second center frequency	$f2_c$
Second highest frequency	$f2_{high}$
Second lowest frequency	$f2_{low}$

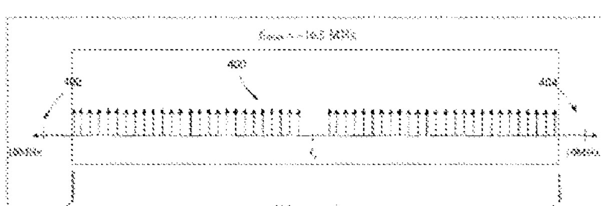
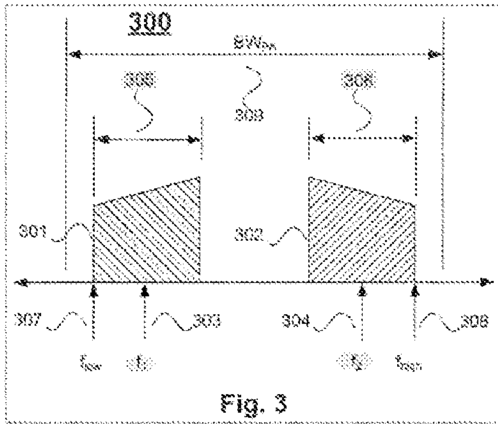
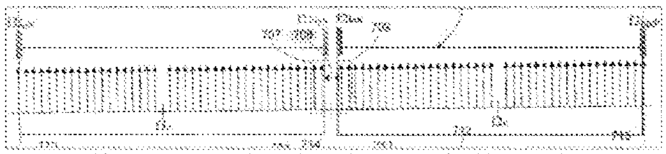


Figure 4

Shearer Fig. 4 (annotated)

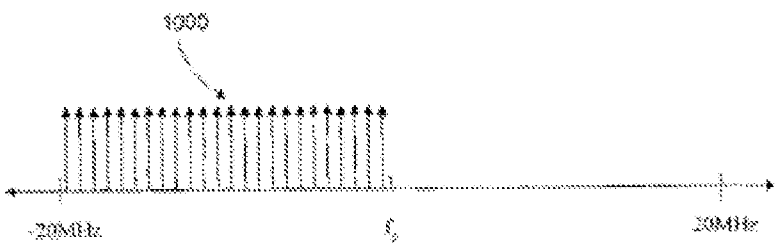


'802 Patent Fig. 3 (Highlighting Added)


Shearer Fig. 7 middle portion only (annotated & highlighted)

(e.g., Lanning Dec., ¶¶ 51 – 55).

Furthermore, Shearer at col. 8:32-51: "[L]ower 20 MHz OFDM transmit kernel 320a sends the signal to an interpolation stage 310a.... The output of interpolation stage 310a is then shifted down by 10 MHz at frequency shift stage 310b." Shearer FIG. 10 illustrates downshifted signal 1000.

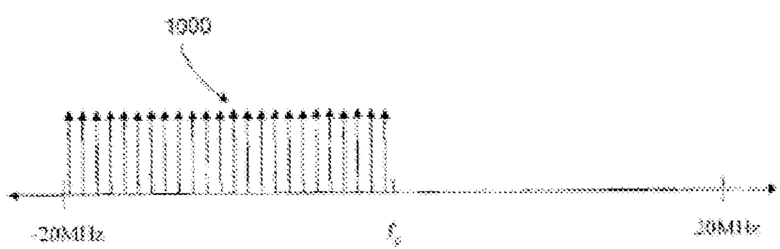


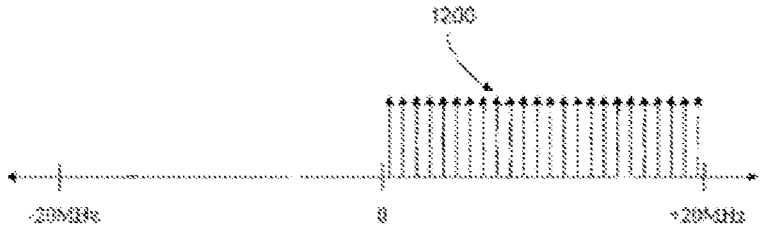
Thus, as described above, the signal 900 is shifted down by 10 MHz to generate the downshifted signal 1000. As described above, the signal 900 has an active (populated) spectrum that is about 16.5 MHz wide. Thus, in this example, the first frequency range has the first center frequency at f_c -10 MHz (i.e., f_c shifted down by 10 MHz), the first lowest frequency at about f_c - 18.25 MHz (i.e., first center frequency minus one-half the active spectrum width of about 16.5

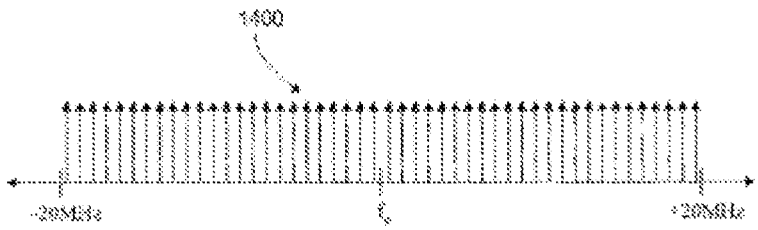
MHz), and the first highest frequency at about f_c - 1.75 MHz (i.e., first center frequency plus one-half the active spectrum width of about 16.5 MHz).

simultaneously transmitting second information across a second frequency range

Shearer discloses simultaneously transmitting second information (e.g., information transmitted using a second 802.11a input signal) across a second frequency range (€.g., the frequency range of up-shifted signal 1200). Shearer at col. 8:22-25: "In one embodiment of an 802.11n system, two 20 MHz 802.1 1a input signals are received at the PHY unit 300 from FIG. 3 substantially simultaneously." Shearer at col. 8:32-51: "[L]ower 20 MHz OFDM transmit kernel 320a sends the signal to an interpolation stage 310a.... The output of interpolation stage 310a is then shifted down by 10 MHz at frequency shift stage 310b." Shearer at col. 8:66-9:7: "[U]pper 20 MHz OFDM transmit kernel 320b sends the signal to an interpolation stage 310c.... The output of interpolation stage 310c is then shifted up by 10 MHz at frequency shift stage 310d." Shearer at col. 9:19-20: "The output of each path is aggregated in adder 310e to achieve, in this exemplary embodiment, a signal 1400 with a 40 MHz bandwidth and a 40 MHz sample rate as shown in FIG. 14." Shearer FIGS. 10, 12, 14 illustrate addition of signals 1000, 1200 into aggregated signal 1400.







Shearer at col. 5:29-33: “The output of symbol wave shaper/interpolator/shifter/summer 310 is sent to modulator 312. The modulator 312 modulates the encoded data onto carriers in OFDM symbols in accordance with conventional OFDM modulation techniques.” Shearer at col. 5:37-42: “The output of the modulator 312 is sent to mixer 314 where it is upconverted to the desired transmit frequency. The upconversion may be performed in multiple mixer stages. From mixer 314, the upconverted signal is amplified in high powered amplifier (HPA) 316 and sent to antenna 318 for transmission.” Alternatively, Shearer FIG. 16 illustrates another embodiment with six simultaneous signals. See id. at col. 9:33-54. Accordingly, any pair of the signals 1602, 1604, 1606, 1608, 1610, 1612 reads on the first frequency range and the second frequency range.

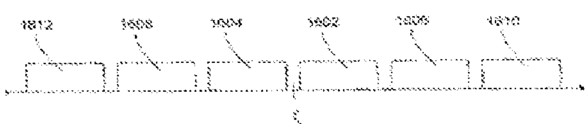


Figure 16

using the same wireless transmitter,

Shearer discloses using the same wireless transmitter (e.g., PHY unit 300). Shearer discloses that the signal paths 800, 1100 are included in the same PHY 300 as shown in FIG. 3, (e.g., Shearer, 2:63-64, “FIG. 8 is a block diagram of an exemplary embodiment of a low

frequency input section to the transmitter of FIG. 3."; 3:4-5, "FIG. 11 is a block diagram of an exemplary embodiment of a high frequency input section to the transmitter of FIG. 3."; 3:9-11, "FIG. 13 is a block diagram of an exemplary embodiment of a system for adding the outputs of the input sections of FIGS. 8 and 11 into a composite signal."). As stated in the Lanning Dec., Figure 13 includes typographical error in indicating the upper path as having a -10 MHz frequency shift and the lower path as having a +10 MHz frequency shift, and those values should be reversed with one another as is readily apparent from Shearer's overall disclosure, see Lanning Dec., Page 40.

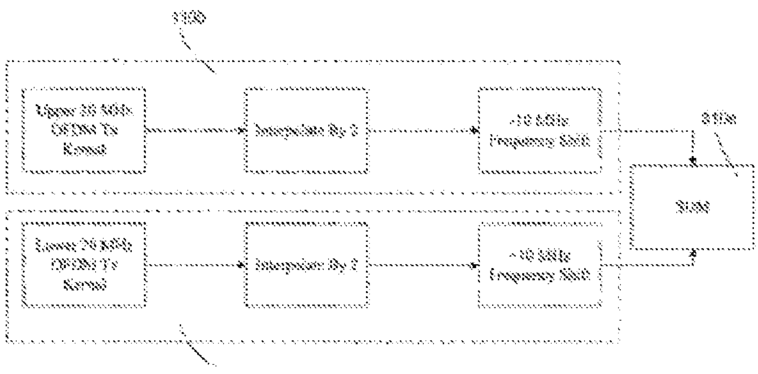


Figure 13

Further, each of the lower 20 MHz OFDM transmit kernel 320a and the upper 20 MHz OFDM transmit kernel 320b correspond to the transmit kernel 320 of FIG. 3, (e.g., Shearer, 8:27-31, 8:61- 66). The frequency shift stages 310b, 310d and the adder 310e correspond to the shaper/interpolator/shifter 310 of FIG. 3, (e.g., Shearer, 5:26-28, 8:51-52, 9:7-8).

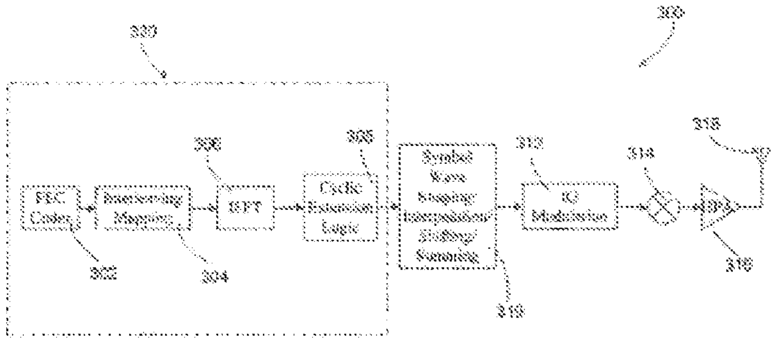
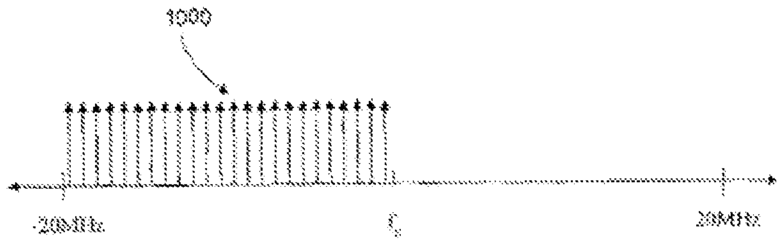


Figure 3

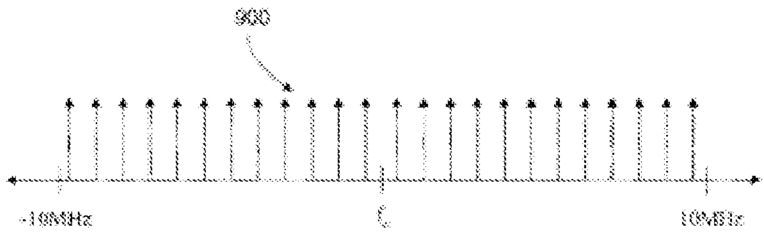
Shearer at col. 5:29-33, "The output of symbol wave shaper/interpolator/shifter/summer 310 is sent to modulator 312. The modulator 312 modulates the encoded data onto carriers in OFDM symbols in accordance with conventional OFDM modulation techniques." Shearer at col. 5:37-42, "The output of the modulator 312 is sent to mixer 314 where it is upconverted to the desired transmit frequency. The upconversion may be performed in multiple mixer stages. From mixer 314, the upconverted signal is amplified in high powered amplifier (HPA) 316 and sent to antenna 318 for transmission." Thus, Shearer discloses transmitting the down-shifted signal 1000 and the up-shifted signal 1200 using the same wireless transmitter 300

> **the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.**

Shearer discloses the second frequency range (e.g., the frequency range of upshifted signal 1200) having a second center frequency (e.g., f_c + 10 MHz) greater than the first center frequency (e.g., f_c - 10 MHz), a second highest frequency (e.g., at about f_c + 18.25 MHz), and a second lowest frequency (e.g., at about f_c + 1.75 MHz). Shearer FIG. 10 illustrates downshifted signal 1000, which as described above reads on the first frequency range with first center frequency, first lowest frequency, and first highest frequency.



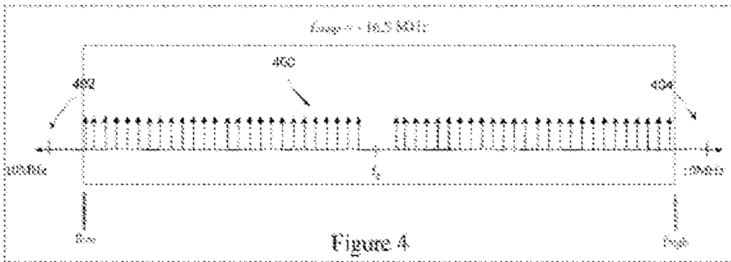
Shearer at col. 8:55-56; "FIG. 9 presents an exemplary 20 MHz 802.11a OFNM signal 900centered at center frequency f_c."



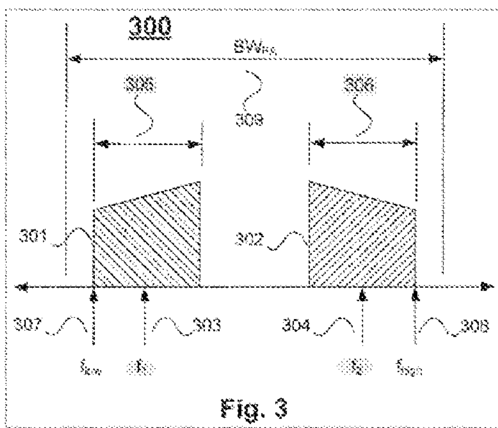
Shearer further discloses that in an example, each input signal has an active frequency range of about 16.5 MHz, less than the nominal 20 MHz channel bandwidth. See, e.g., Shearer at col. 5:43-44. ("In an IEEE 802.11a/g design, each transmission channel has a bandwidth of 20 MHz."), col.5:50-54. (As a "nonlimiting example, there are sixty-four (64) subcarrier bins" and "52 of the bins are populated with non-zero subcarriers."), col. 5:62-64 ("In a 20 MHz packet, the active (populated) subcarriers span a spectrum somewhat less than 20 MHz wide, about 16.5 MHz, in this nonlimiting example."). Note that the exemplary OFDM signal 900 shown in FIG. 9 illustrates the OFDM subcarriers spanning a spectrum somewhat less than 20 MHz wide (i.e., not extending all the way from f_c - 10 MHz to f_c + 10 MHz).

As explained in the Lanning Dec., Shearer discloses that each of frequency ranges "is about 16.5 MHz," which is less than the channel spacing of 20 MHz. (See Lanning Dec., EX1003 ¶¶ 51-53.). As also seen in the Lanning Dec., they have supplied annotations to show how the frequencies would be categorized as stated in the claim.

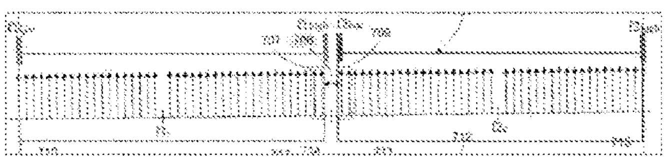
Claim Term	Notation
First frequency range	$f1_{range}$
First center frequency	$f1_c$
First highest frequency	$f1_{high}$
First lowest frequency	$f1_{low}$
Second frequency range	$f2_{range}$
Second center frequency	$f2_c$
Second highest frequency	$f2_{high}$
Second lowest frequency	$f2_{low}$



Shearer Fig. 4 (annotated)

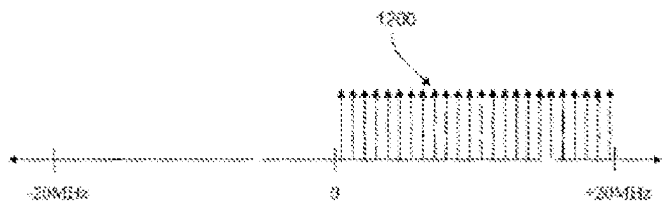


'802 Patent Fig. 3 (Highlighting Added)


Shearer Fig. 7 middle portion only (annotated & highlighted)

(e.g., Lanning Dec., ¶¶ 51 – 55).

Furthermore, Shearer at col. 8:66-9:7: "[U]pper 20 MHz OFDM transmit kernel 320b sends the signal to an interpolation stage 310c.... The output of interpolation stage 310c is then shifted up by 10 MHz at frequency shift stage 310d." Shearer FIG. 12 illustrates upshifted signal 1200.



Thus, as described above, the signal 900 is shifted down by 10 MHz to generate the downshifted signal 1000. As described above, the signal 900 has an active (populated) spectrum that is about 16.5 MHz wide. Thus, in this example, the first frequency range has the first center frequency at f_c -10 MHz (i.e., f_c shifted down by 10 MHz), the first lowest frequency at about f_c - 18.25 MHz (i.e., first center frequency minus one-half the active spectrum width of about 16.5 MHz), and the first highest frequency at about f_c - 1.75 MHz (i.e., first center frequency plus one-half the active spectrum width of about 16.5 MHz).

Alternatively, Shearer FIG. 16 illustrates another embodiment with six simultaneous signals, (e.g., 9:33-54). In this embodiment, for an even number of simultaneous signals, “each signal is shifted from the center frequency by a succeeding multiple of the bandwidth (BW) of the signal.”, (e.g., Shearer, col. 9:31-33). For example, signal 1602 is shifted up by BW/2, signal 1604 is shifted down by BW/2, signal 1606 is shifted up by 3*BW/2, and so on, (e.g., Shearer,. 9:37-42). Thus, each of the shifted signals 1602-1612 has a center frequency, lowest frequency, and highest frequency determined based on the number of simultaneous signals and the bandwidth of each signal.

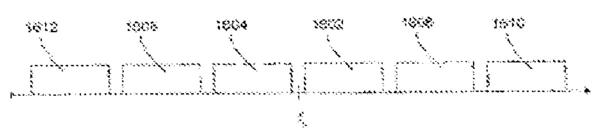


Figure 16

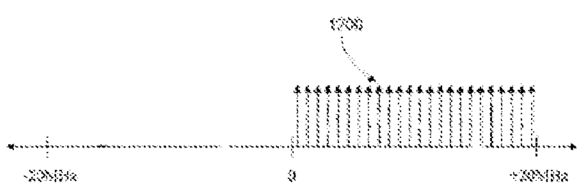
RE: Claim 2

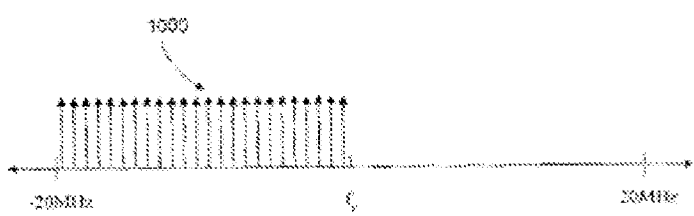
> **The method of claim 1 wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.**

Shearer further discloses a frequency difference (e.g., 20 MHz) between the first center frequency (e.g., f_c - 10 MHz) and the second center frequency (e.g., f_c + 10 MHz) is greater than the sum of one-half the first frequency range (e.g., about 8.25 MHz) and one-half the second frequency range (e.g., about 8.25 MHz, for a sum of about 16.5 MHz).

Shearer at col. 5:43-44, ("In an IEEE 802.11a/g design, each transmission channel has a bandwidth of 20 MHz."; col. 5:50- 54, "As a "nonlimiting example, there are sixty-four (64) subcarrier bins" and "52 of the bins are populated with non- zero subcarriers."; 5:62-64, "In a 20 MHz packet, the active (populated) subcarriers span a spectrum somewhat less than 20 MHz wide, about 16.5 MHz, in this nonlimiting example.").

As explained in the Lanning Dec., Shearer discloses that each of frequency ranges "is about 16.5 MHz," which is less than the channel spacing of 20 MHz., (See Lanning Dec. ¶¶ 51-53.) Thus, the sum of 1/2 the first frequency range and 1/2 the second frequency range is equal to one frequency range, or "about 16.5 MHz." Shearer FIGS. 10 and 12 illustrate downshifted signal 1000 and upshifted signal 1200.





Shearer at col. 8:32-51: "[L]ower 20 MHz OFDM transmit kernel 320a sends the signal to an interpolation stage 310a.... The output of interpolation stage 310a is then shifted down by 10 MHz at frequency shift stage 310b."

Shearer at col. 8:66-9:7: "[U]pper 20 MHz OFDM transmit kernel 320b sends the signal to an interpolation stage 310c.... The output of interpolation stage 310c is then shifted up by 10 MHz at frequency shift stage 310d."

Thus, first frequency range has center frequency at f_c - 10 MHz, and second frequency range has center frequency at f_c + 10 MHz. The difference is 20 MHz, which is greater than "about 16.5 MHz." See also Shearer FIG. 16; col. 9:25 to 10:31. In additional embodiments, more than two signals may be shifted and aggregated into the aggregated signal for transmission. Center frequencies of non-adjacent signals (e.g., 1604 and 1606 in the illustrative example) are separated by more than one frequency range amount.

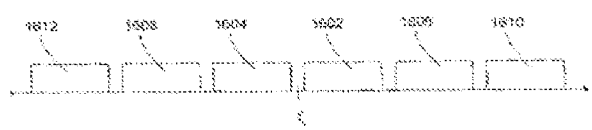


Figure 16

Continuing the example shown in FIG. 16, each of the signals B 1604, C 1606 has a bandwidth BW. Shearer at col. 9:31-33. Thus, the sum of 1/2 the frequency range of signal B 1604 and 1/2 the frequency range of signal C 1606 is equal to BW. The center frequency of the signal B 1604 is shifted down by BW/2 and the center frequency of the signal C 1606 is shifted up by 3*BW/2. Shearer at col. 9:51-52. Thus, the difference between the center frequency of the signal B 1604 and the signal C 1606 is 2* BW. which is greater than BW, (e.g., Lanning Dec. ¶¶ 42-45).

RE: Claim 3

The method of claim 1 wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter.

Shearer further discloses the additional limitations of claim 3. Shearer further discloses the first and second information (e.g., information in the first 802.11a input signal and information in the second 802.11a input signal) are transmitted using the same power amplifier (e.g., HPA 316) in said wireless transmitter (e.g., PHY unit 300).

Shearer discloses that the signal paths 800, 1100 are included in the same PHY 300 as shown in FIG. 3, (e.g., Shearer, 2:63-64, 3:4-5, 3:9-11). As shown, PHY 300 includes a single high-power amplifier 316.

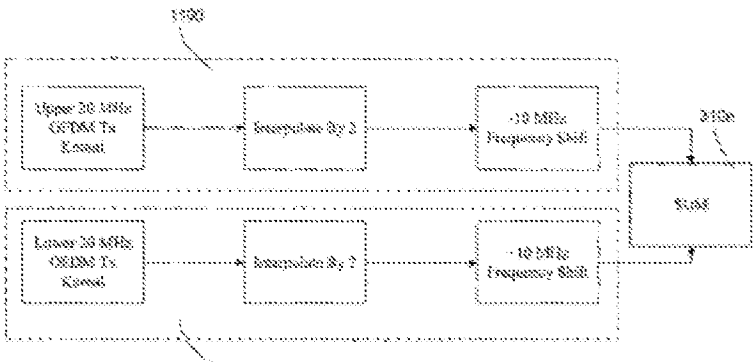


Figure 13

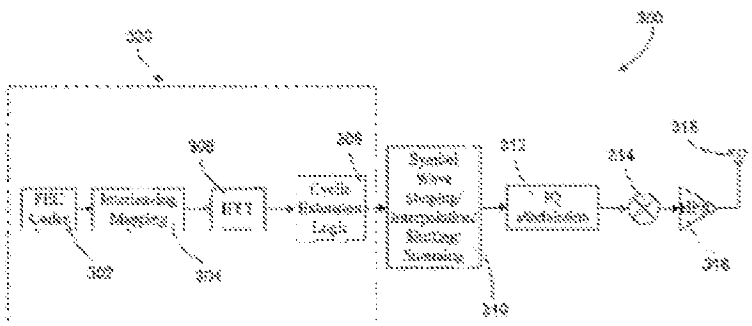


Figure 3

Shearer, 5:40 – 43, “From mixer 314, the upconverted signal is amplified in high powered amplifier (HPA) 316 and sent to antenna 3`8 for transmission.”

RE: Claim 4

> **The method of claim 3 wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.**

Shearer further discloses the additional limitations of claim 4. Shearer further discloses the bandwidth of said power amplifier (e.g., at least 40 MHz bandwidth of HPA 316 for two 20MHz channels, at least 830MHz for four 20MHz channels, and at least 120MHz for six 20MHz channels) is greater than the difference (e.g., 36.5 MHz) between the first lowest frequency (e.g., f_c - 18.25 MHz) and the second highest frequency (e.g., f_c + 18.25 MHz). As discussed in connection with claim 3, Shearer discloses that the signal paths 800, 1100 are included in the same PHY 300 as shown in FIG. 3, (e.g., Shearer, 2:63-64, 3:4-5, 3:9-11). As shown, PHY 300 includes a single high-power amplifier 316. Shearer also discloses amplifying and transmitting at least two 20 MHz channels, which is at least a total bandwidth for the HPA of 40 MHz, (e.g., Shearer, 6:29-43). Thus, HPA bandwidth of 40, 80, or 120 MHz is each greater than Shearer’s 36.5 MHz. Because Shearer discloses amplifying the composite signal with the HPA 316, it also discloses that the HPA 316 has bandwidth of at least the bandwidth of the composite signal (i.e., the difference between the lowest and the highest frequencies of the respective shifted signals), (see Lanning Dec., ¶¶ 64-66). Additionally, Shearer at FIG. 16 discloses amplifying a composite signal with more than two shifted signals using the same HPA 316, (e.g., Shearer, 9:31-54). Thus, Shearer discloses that the HPA 316 has a bandwidth that is greater than the bandwidth of two or more those frequency ranges (e.g., total bandwidth of the

HPA must be greater than difference between lowest frequency of signal 1604 and highest frequency of signal 1606, etc.), (See Lanning Dec. ¶ 67).

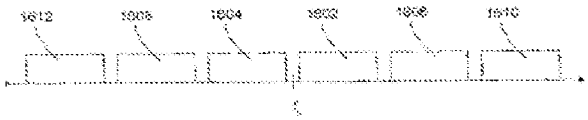


Figure 16

Thus, HPA bandwidth of 40, 80, or 120 MHz is each greater than Shearer's 36.5 MHz (spans of the lowest of the first and the highest of the second frequency ranges).

35 USC § 103

2. **Claims 5 and 9 are** rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Shearer as applied to claim 1 above, and further in view of Rao.

RE: Claim 5

> **The method of claim 1 further comprising concurrently changing the first center frequency to a third center frequency and the second center frequency to a fourth center frequency, wherein the fourth center frequency is greater than the third center frequency, and**

Shearer as modified by Rao further discloses, or at least renders obvious, the additional limitations of claim 5. Rao discloses concurrently changing (e.g., hopping) the first center frequency (e.g., 3432 MHz) to a third center frequency (e.g., 3960 MHz) and the second center frequency (e.g., 5016 MHz) to a fourth center frequency (e.g., 5544 MHz), wherein the fourth center frequency is greater than the third center frequency (e.g., 5544 MHz > 3960 MHz). Rao at 559, col. 1: "The transmitted OFDM symbols are time- interleaved across the sub bands. An advantage of this approach is that the average transmitted power is the same as a system designed to operate over the entire bandwidth." Rao at 560, col. 1: "MB-OFDM signals hop

between 14 band center frequencies according to the specified time-frequency code." Rao discloses the band allocation in Table 1: As shown, each band center frequency is separated by 528 MHz (..e., "at least" the frequency range).

TABLE 1 – OFDM PHY BAND ALLOCATION

Band Group	Band ID	Lower Frequency (MHz)	Center Frequency (MHz)	Upper Frequency (MHz)
1	1	3168	3432	3696
	2	3696	3960	4224
	3	4224	4488	4752
2	4	4752	5016	5280
	5	5280	5544	5808
	6	5808	6072	6336
3	7	6336	6600	6864
	8	6864	7128	7392
	9	7392	7656	7920
4	10	7920	8184	8448
	11	8448	8712	8976
	12	8976	9240	9504
5	13	9504	9768	10032
	14	10032	10296	10560

Rao further describes the effect of the time-frequency code mathematically as a gate function based on the number of bands and "the number of periods the signal dwells in each band," also called "dwells." Rao at 560 col. 1 to col. 2. The number of bands and dwells for each code are shown in Table 2.

Table 2–The number of bands and dwells for MB-OFDM signals

Signal	Bands	Dwell
MB-1	1	1
MB-2	3	1
MB-3	3	2
MB-4	7	1
MB-5	7	2
MB-6	7	6
MB-7	13	1
MB-8	13	2
MB-9	13	12

As shown in Table 2, a time-frequency code includes 3 bands and 1 dwell, meaning that the signal would hop every period to a regular pattern of 3 bands, such as bands 1, 2, 3 in band group 1, or bands 4, 5, 6 in band group 2. As shown in Table 1, of the 14 sub-bands, two updated bands would be selected by a time- frequency code such that the fourth center frequency (e.g., 5544 MHz of band 5) is greater than the third center frequency (e.g., 3960 MHz of band 2). Therefore, combining the simultaneous transmission on multiple frequency ranges of Shearer with the time-interleaved frequency hopping of Rao, applied to each of the frequency ranges of Shearer, reaches the predictable result of concurrently changing the first center frequency to a third center frequency and the second center frequency to a fourth center frequency, wherein the fourth center frequency is greater than the third center frequency.

wherein the first center frequency changes by at least the first frequency range and the second center frequency changes by at least the second frequency range, and

Shearer as modified by Rao's frequency hopping renders obvious wherein the first center frequency (e.g., at Rao's 3432 MHz) changes by at least the first frequency range (e.g., Rao's 528 MHz) and the second center frequency (e.g., at Rao's 5016 MHz) changes by at least the second frequency range (€.g., Rao's 528 MHz). See Rao at 559, col. 1: "This definition provides a unique numbering system for all channels that have a spacing of 528 MHz and lie within the band 3.1 — 10.6 GHz." See also Rao Table 1: As shown, each band center frequency is separated by 528 MHz (i.e., "at least" the frequency range).

TABLE 1 – OFDM PHY BAND ALLOCATION

Band Group	Band ID	Lower Frequency (MHz)	Center Frequency (MHz)	Upper Frequency (MHz)
1	1	3168	3432	3696
	2	3696	3960	4224
	3	4224	4488	4752
2	4	4752	5016	5280
	5	5280	5544	5808
	6	5808	6072	6336
3	7	6336	6600	6864
	8	6864	7128	7392
	9	7392	7656	7920
4	10	7920	8184	8488
	11	8488	8712	8976
	12	8976	9240	9504
5	13	9504	9768	10032
	14	10032	10296	10560

Applying Rao's frequency hopping between at least adjacent based to Shearer's specific frequencies renders obvious wherein the first center frequency changes by at least the first frequency range and the second center frequency changes by at least the second frequency range which would have been understood to avoid risk of interference in overlapping frequency ran ges.

wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies.

Shearer as modified by Rao discloses the bandwidth of said power amplifier (e.g., Shearer's at least 40 MHz bandwidth of HPA 316 for two 20MHz channels, at least 80MHz for four 20MHz channels, and at least 120MHz for six 20MHz channels) is greater than the difference (e.g., 36.5 MHz) between the first lowest frequency and the second highest frequency for the changed first and second center frequencies (e.g., 1606, 1610 respectively). As discussed in connection with claim 3, Shearer discloses that the signal paths 800, 1100 are included in the same PHY 300 as shown in FIG. 3. *Id.* col. 2:63-64, 3:4-5, 3:9-11. As shown, PHY 300 includes a single high-power amplifier 316. Because Shearer discloses amplifying the composite signal with the HPA 316, it also discloses that the HPA 316 has bandwidth of at least the BW of the composite signal (i.e., difference between lowest and highest frequencies of respective sub-

bands). Additionally, Shearer at FIG. 16 discloses amplifying a composite signal with more than two shifted signals using the same HPA 316. See also id. at col. 9:31-54. Thus, Shearer discloses that the HPA 316 has a bandwidth that is greater than the bandwidth of two or more those frequency ranges (e.g., total bandwidth of the HPA must be greater than difference between lowest frequency of signal 1604 and highest frequency of signal 1606, etc.).

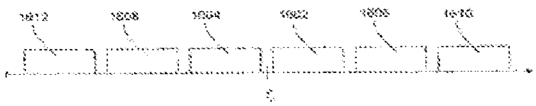


Figure 16

As shown in FIGS. 14, 16, bandwidth of the HPA 316 is relative to the center frequency f_c Accordingly. changing the center frequency fc does not change the relative positions of the signals 1602-1612. Thus, the same disclosure related to FIGS. 14, 16 also applies to the "difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies." Thus, Shearer's HPA bandwidth of 80 or 120 MHz is each greater than Shearer's 36.5 MHz (spans of the lowest of the first and the highest of the second frequency ranges). And applying Rao's teachings, for example, hopping Shearer's signals 1604, 1602 to the frequency ranges of 1606, 1610, respectively, Shearer's 80 or 120MHz amplifier remains greater in bandwidth than the difference between the 36.5MHz span of the changed (hopped) frequencies, (see Lanning Dec., ¶¶ 95).

Claim 9

> **The method of claim 1 wherein first information and second information comprise a plurality of OFDM symbols,**

Shearer discloses first information and second information comprise a plurality of OFDM symbols. Shearer, e.g., at col. 5:30-33 ("The modulator 312 modulates the encoded data onto carriers in OFDM symbols in accordance with conventional OQFI)M modulation techniques.")

> **wherein a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range, and**

Shearer discloses a first symbol (e.g., OFDM symbol) is transmitted during a first time slot (e.g., between start time 1902 and end time 1904) across the first frequency range (e.g., downshifted signal 1000) and a second symbol is transmitted during the first time slot (e.g., simultaneously between start time 1902 and end time 1904) across the second frequency range (e.g., upshifted signal 1200). Shearer, e.g., at col. 5:30-33 ("The modulator 312 modulates the encoded data onto carriers in OFDM symbols in accordance with conventional OFDM modulation techniques."). Shearer at col. 8:23-26 ("two 20 MHz 802.11a input signals are received at the PHY unit 300 from FIG. 3 substantially simultaneously. The two signals are processed separately, one in a lower 20 MHz path and one in an upper 20 MHz path."), 9:19-22 ("The output of each path is aggregated in adder 310e to achieve, in this exemplary embodiment, a signal 1400 with a 40 MHz bandwidth and a 40 MHz sample rate as shown in FIG. 14"). Shearer at col. 10:32-38 ("Each signal's start time 1902 and end time 1904 is preferably substantially equivalent to eliminate problems with multiple signal acquisition and termination. These problems may include transmitting and receiving simultaneously. By occupying 'both' channels at the same time, simultaneous transmitting and receiving is enabled."), fig. 19.

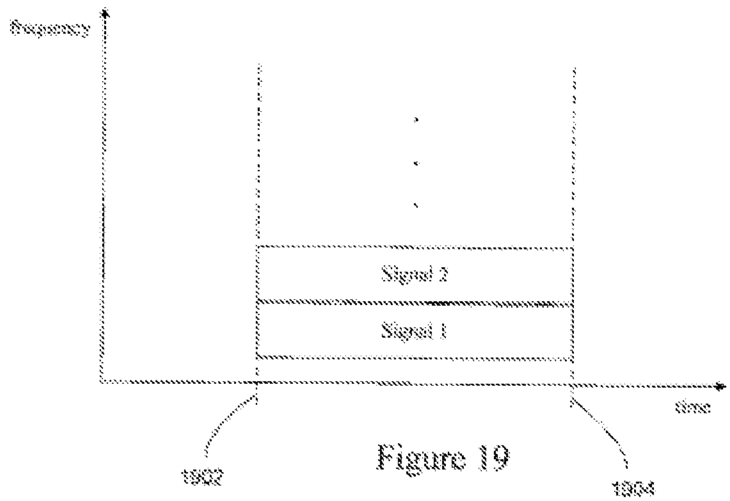


Figure 19

Thus, Shearer discloses transmitting first and second symbols (e.g., OFDM symbols) across first and second frequency ranges (e.g., signals 1000, 1200) during "the first time slot" (e.g., at the same time). Shearer does not expressly disclose a particular duration for the "time slot" for each symbol. However, Shearer discloses that encoded data is modulated "in accordance with conventional OFDM modulation techniques," and it is well known that 802.11a data symbols used a 4 microsecond duration, which reads on "first time slot." Rao discloses a first symbol is transmitted during a first time slot (e.g., MB-OFDM symbol period) across the first frequency range (e.g., sub-band). Rao at 560, col. 1: "The 128 tone (16-QAM symbols) coefficients are inverse transformed to obtain data block samples ... where D_n is the n^{th} QAM symbol .... The MB- OFDM symbol is formed by placing the data block between the 32-sample zero prefix and 5-sample guard interval suffix making the total symbol length of L=165 samples." Rao at 560, col. 1: "$T_{OFDM} = L\Delta t$ = 312.5 nanoseconds is the MB-OFDM symbol period... ." Thus, Rao also discloses transmitting OFDM symbols in a first time slot (e.g., OFDM symbol period).

Therefore, even if it is found that Shearer doesn't expressly disclose simultaneous transmission in multiple frequency ranges of two symbols in the first time slot, then the

simultaneous transmission in multiple frequency ranges of Shearer combined with the MB-OFDM symbol period of Rao, applied to both frequency ranges of Shearer, reaches "a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range", and would be obvious for similar reasons stated above.

> **wherein a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range.**

Shearer discloses a third symbol (e.g., OFDM symbol) is transmitted during a second time slot (e.g., between start time 1902 and end time 1904) across the first frequency range (€.g., the downshifted signal 1000) and a fourth symbol (e.g., OFDM symbol) is transmitted during the second time slot (e.g., simultaneously between start time 1902 and end time 1904) across a second frequency range (e.g., the upshifted signal 1200). Shearer, e.g., at col. 5:30-33 ("The modulator 312 modulates the encoded data onto carriers in OFDM symbols in accordance with conventional OFDM modulation techniques."). Shearer at col. 8:23-26 ("two 20 MHz 802.11a input signals are received at the PHY unit 300 from FIG. 3 substantially simultaneously. The two signals are processed separately, one in a lower 20 MHz path and one in an upper 20 MHz path."), 9:19-22 ("The output of each path is aggregated in adder 310e to achieve, in this exemplary embodiment, a signal 1400 with a 40 MHz bandwidth and a 40 MHz sample rate as shown in FIG. 14"). Shearer at col. 10:32-38 ("Each signal's start time 1902 and end time 1904 is preferably substantially equivalent to eliminate problems with multiple signal acquisition and termination. These problems may include transmitting and receiving simultaneously. By occupying 'both' channels at the same time, simultaneous transmitting and receiving is enabled."), fig. 19. Shearer also discloses that data is transmitted as "packets" that include

multiple OFDM “data symbols,” and thus discloses transmission of the third symbol and the fourth symbol during a second time slot (different from the first time slot).

Shearer illustrates at FIGS. 21-22 “two types of packets, for example for both 20 MHz and 40 MHz.” *Id*. at col. 11:23-24. Each type of packet includes multiple “data symbols.” See, e.g., *Id*. at col. 11:26-29 (mixed-mode packet 2100 with data symbols 2112), col. 11:46-48 (packet 2200 with data symbols 2208). The packets are illustrated in FIGS. 21-22 in sequential order. *Id*. 11:32-35 (“As such, a mixed-mode packet can start with a legacy preamble/ header 2102, 2104, 2106 and then follow with additional extended header/ preamble signal 2108, 2110.”); 11:46-48 (“As such, the packet [2200] begins immediately with an extended preamble/ header 2202, 2204, 2206, followed by data symbols 2208.”). Thus, Shearer discloses sending packets with multiple data symbols, which are transmitted sequentially as shown in FIGS. 21-22. Thus, Shearer discloses transmitting third and fourth symbols (e.g., OFDM symbols) across first and second frequency ranges (e.g., signals 1000, 1200) during “the second time slot” (e.g., simultaneously at a different time from the first time slot). Shearer does not expressly disclose a particular duration for the “time slot” for each symbol. However, Shearer discloses that encoded data is modulated “in accordance with conventional OFDM modulation techniques,” and it is well known that 802.11a data symbols used a 4 microsecond duration, which reads on “second time slot.” Rao discloses a third symbol is transmitted during a second time slot (e.g., MB-OFDM symbol period) across the first frequency range (e.g., sub-band).

Rao discloses a first symbol is transmitted during a first time slot (e.g., MB-OFDM symbol period) across the first frequency range (e.g., sub-band). Rao at 560, col. 1: “The 128 tone (16-QAM symbols) coefficients are inverse transformed to obtain data block samples ... where D_n is the n^{th} QAM symbol .... The MB- OFDM symbol is formed by placing the data

block between the 32-sample zero prefix and 5-sample guard interval suffix making the total symbol length of L=165 samples." Rao at 560, col. 1: "$T_{OFDM} = L\Delta t$ = 312.5 nanoseconds is the MB-OFDM symbol period... ." Thus, Rao also discloses transmitting OFDM symbols in a first time slot (e.g., OFDM symbol period). Therefore, it would have been obvious to one of ordinary skill in the art to combine Rao with Shearer because of similar reasons stated above.

3. **Claim 6 is** rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Shearer as applied to claim 1 above, and further in view of Kim.

RE: Claim 6

The method of claim 1 wherein the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol.

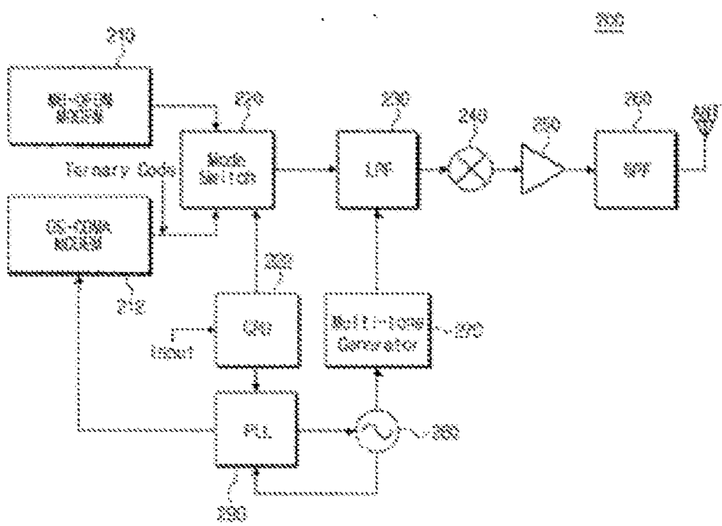
Shearer discloses the first information corresponds to a first wireless protocol (e.g., IEEE 802.11 OFDM) and the second information corresponds to a second wireless protocol (¢.g., IEEE 802.11 OFDM). Shearer discloses that Bluetooth and IEEE 802.11 are "wireless protocols." Shearer at col. 1:39-42 ("Wireless protocols such as Bluetooth and IEEE 802.11 support the logical interconnections of such portable roaming terminals having a variety of types of communication capabilities to host computers."). Shearer discloses transmission of multiple data signals using the same wireless protocol (i.e., two simultaneous 802.11la OFDM signals). Shearer at col. 8:22-25. Claim 6 does not require that the "first wireless protocol" or the "second wireless protocol" be different.

Additionally, Shearer in view of Kim discloses the first information corresponds to a first wireless protocol (e.g., OFDM) and the second information corresponds to a second wireless

protocol (e.g., DS-CDMA). As discussed above, Shearer discloses transmission of multiple data signals using the same wireless protocol (i.e., two simultaneous 802.11a OFDM signals). Shearer at col. 8:22-25.

Kim discloses a transmitter capable of performing two methods of ultrawideband wireless transmission. Kim ¶ [0007] (“There are two UWB communication methods currently available which satisfy the limits placed on power emission. One is a multi-band orthogonal frequency division multiplexing (MB- OFDM) method in which the band of approximately 3.1-10.6 GHz is divided by 528 MHz and each resulting band is frequency-hopped using an UWB signal of an OFDM type. The other one is a direct sequence code division multiple access (DS-CDMA) method in which the band of approximately 3.1 - 10.6 GHz is divided in half and a 24-bit codeword is substituted for a bit sequence of each band using an UWB signal.”).

Kim ¶ [0046] (‘The UWB network transmitter 200 according to an exemplary embodiment of the present invention includes an MB-OFDM modem 210, a DS-CDMA modem 212, a mode switch 220, a central processing unit (CPU) 222, a low-pass filter (LPF) 230, a mixer 240, an amplifier 250, a band-pass filter (BPF) 260, a multi-tone generator 270, a voltage controlled oscillator (VCO) 280 and a phase lock loop (PLL) 290.”)



Kim ¶ [0047] (‘The MB-OFDM modem 210 modulates a transmission signal of the MB-OFDM type and the DS-CDMA modem 212 modulates a transmission signal of the DS-CDMA type.”). The MB-OFDM modem 210 and the DS-CDMA modem 212 are connected to a mode switch 220, which passes a selected transmission signal to a mixer 240 and an amplifier 250 for transmission via an antenna. See Kim ¶ [0046], [0048], [0051]. See also Kim ¶ [0086] (“[W]hen the MB-OFDM transceiver and the DS-CDMA transceiver are used at the same time according to an exemplary embodiment of the present invention, the problem of frequencies of each other’s transceivers operating as noise and interference is resolved.”). Therefore, the simultaneous transmission of first information and second information on multiple frequency ranges of Shearer as modified by the transceiver capable of transmitting with multiple wireless protocols of Kim (e.g., MB-OFDM and DS-CDMA) renders the combination obvious.

4. **Claims 7 and 8 are** rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Shearer as applied to claim 1 above, and further in view of Balakrishnan.

RE: Claim 7

The method of claim 1 wherein the first information and the second information are the same data transmitted across two different frequencies.

Balakrishnan discloses the first information (e.g., third bit stream) and the second information (e.g., fourth bit stream) are the same data transmitted across two different frequencies (e.g., information bit stream 340 in transmit diversity mode). Balakrishnan ¶ [0029]: “In an embodiment, the bits of an information bit stream 340 may be provided by a higher layer application and are encoded, interleaved, and divided into two parallel bit streams, which may be referred to as two precursor signals, by an encoder/interleaver component 342... . Alternatively,

in another embodiment, a third bit stream may contain every bit of the information bit stream 340 and a fourth bit stream may contain every bit of the information bit stream 340 modified in a known way to increase the probability that the combination of the third and fourth bit streams may be correctly demodulated at the receiver 322. The transmission involving duplication of information bit stream 340 may be termed transmit diversity mode." Therefore, the simultaneous transmission of first information and second information on multiple frequency ranges of Shearer combined with the transmit diversity mode of Balakrishnan renders obvious the first information and the second information are the same data transmitted across two different frequencies for similar reasons stated above.

RE: Claim 8

The method of claim 1 wherein the first information and second information are from the same data stream.

Balakrishnan discloses the first information (e.g., first bit stream) and the second information (e.g., second bit stream) are from the same data stream (e.g., information bit stream 340). Balakrishnan ¶ [0029]: "In an embodiment, the bits of an information bit stream 340 may be provided by a higher layer application and are encoded, interleaved, and divided into two parallel bit streams, which may be referred to as two precursor signals, by an encoder/interleaver component 342. In an embodiment, the two parallel bit streams may be provided by the encoder/interleaver component 342, as for example a first bit stream containing bits of every other bit of the information bit stream 340 and a second bit stream containing the remaining bits of the information bit stream 340." Therefore, the simultaneous transmission of first information and second information on multiple frequency ranges of Shearer combined with the encoder/interleaver 342 that provides two parallel bit streams from an information bit stream 340

of Balakrishnan reaches the first information and the second information are from the same data stream and would be obvious for similar reasons stated above.

5. Claim(s) 10, 13, 17, 18, 21, and 22 are rejected under 35 U.S.C. 103(a) as being obvious over Rofougaran in further view of Jäntti.

RE: Claim 10

A method of transmitting information in a wireless communication channel comprising:

To the extent the preamble is limiting, Rofougaran discloses a method of transmitting information in a wireless communication channel (e.g., a wireless communication mode utilizing a communication protocol or standard such as cellular communication, wireless networking, television, etc.). Rofougaran 2:38-41 ("The communication system (or device) may comprise characteristics of any of a variety of communication systems/devices (e.g., multimode wireless communication devices)."); 2:41-44 ("For example and without limitation. the communication system may comprise characteristics of any of a variety of mobile wireless communication devices (e.g., cellular phones, paging devices, portable email devices, etc.)."); 2:60-3:3 ("For the following discussion, a communication mode may generally be considered to coincide with communication utilizing a particular communication protocol or standard. A non-limiting list of exemplary communication protocols includes various cellular communication protocols .. . , various wireless networking protocols or standards, including WLAN, WMAN, WPAN and WWAN ...., various television communication standards, etc.").

receiving a first digital signal comprising first data to be transmitted;

Rofougaran discloses receiving a first digital signal comprising first data (e.g., communication protocol data) to be transmitted (e.g., first baseband signal).

See Rofougaran fig. 7 (first baseband signal)

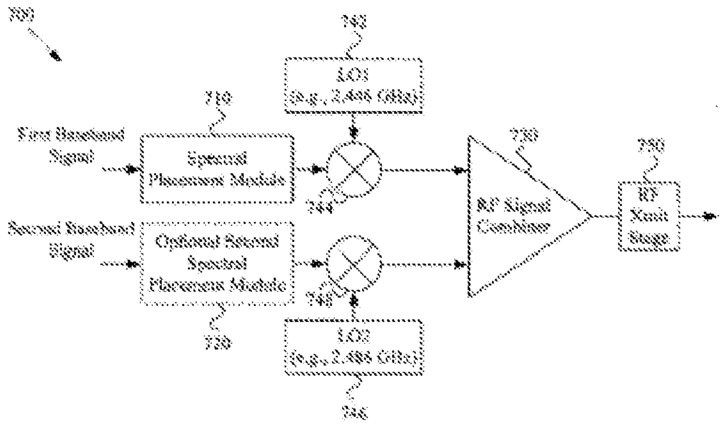
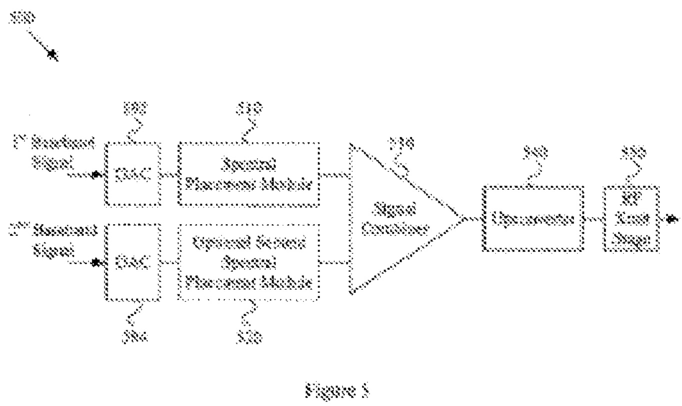


Figure 7

Although not expressly illustrated in FIG. 7 as a digital signal, Rofougaran indicates that the first baseband signal is in the digital domain. See Rofougaran 10:18-22 (“The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously.”). Rofougaran 5:64-6:4 (“Various components of the exemplary communication system 100 (and other communication systems illustrated and discussed herein) may be implemented in analog and/or digital circuitry. To illustrate this, the exemplary communication system 100 is not shown with analog-to-digital converters (ADCs) or digital-to-analog converters (DACs). FIGS. 4-6, to be discussed later, show various non-limiting exemplary configurations including such converters.”).

See Rofougaran fig. 5 (1 Baseband Signal):

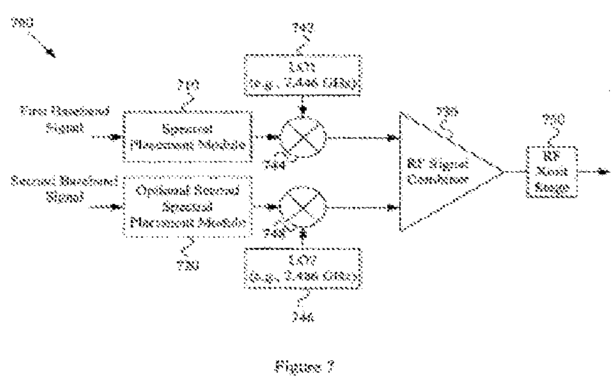


See Rofougaran 9:30-34 ("[T]he spectral placement module 510, optional second spectral placement module 520 and signal combiner 530 may operate in the analog domain. The first digital-to-analog converter 592 may convert the first baseband signal to the analog domain for processing by the spectral placement module 510."). Thus, the first baseband signal is in digital domain. Rofougaran 3:9-14 ("The first baseband signal may, for example, correspond to a first communication protocol (e.g., any of a variety of wireless communication protocols and/or standards). For example and without limitation, the first baseband signal may correspond to any of the previously mentioned communication protocols"').

receiving a second digital signal comprising second data to be transmitted;

Rofougaran discloses receiving a second digital signal comprising second data (e.g., communication protocol data) to be transmitted (e.g., second baseband signal).

See Rofougaran fig. 7 (second baseband signal)



Although not expressly illustrated in FIG. 7 as a digital signal, Rofougaran indicates that the second baseband signal is in the digital domain. See e.g., citations immediately below.

See Rofougaran 10:18-22 (“The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously.”). Rofougaran 5:64-6:4 (“Various components of the exemplary communication system 100 (and other communication systems illustrated and discussed herein) may be implemented in analog and/or digital circuitry. To illustrate this, the exemplary communication system 100 is not shown with analog-to-digital converters (ADCs) or digital-to-analog converters (DACs). FIGS. 4-6, to be discussed later, show various non-limiting exemplary configurations including such converters.”).

See Rofougaran Fig. 5 (2nd Baseband Signal):

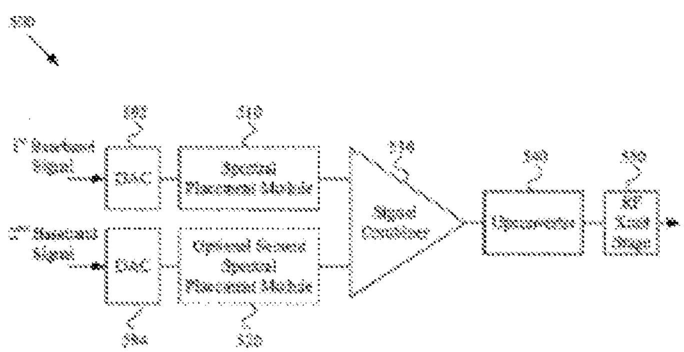


Figure 5

See Rofougaran 9:30-38 (“[T]he spectral placement module 510, optional second spectral placement module 520 and signal combiner 530 may operate in the analog domain. ... The second digital-to-analog converter 594 may convert the second baseband signal to the analog domain for processing by the second spectral placement module 520 or signal combiner 530.”). Thus, the second baseband signal is in digital domain. Rofougaran 3:17-23 (“The second baseband signal may, for example, correspond to a second communication protocol (e.g., a

second communication protocol different from the first communication protocol discussed above). For example and without limitation, the second baseband signal may correspond to any of the previously mentioned communication protocols.'').

converting the first digital signal into a first analog signal using a first digital-to-analog converter,

Rofougaran discloses converting the first digital signal (e.g., first baseband signal) into a first analog signal (e.g., first baseband signal in analog domain) using a first digital-to- analog converter (e.g., DAC 592 from FIG. 5).

See Rofougaran fig. 7 (first baseband signal).

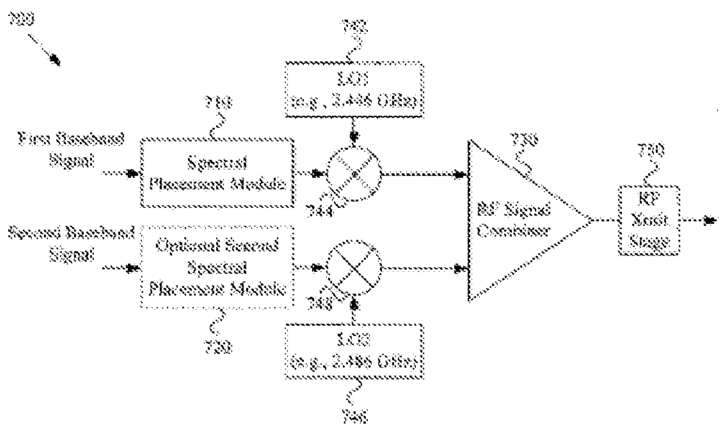
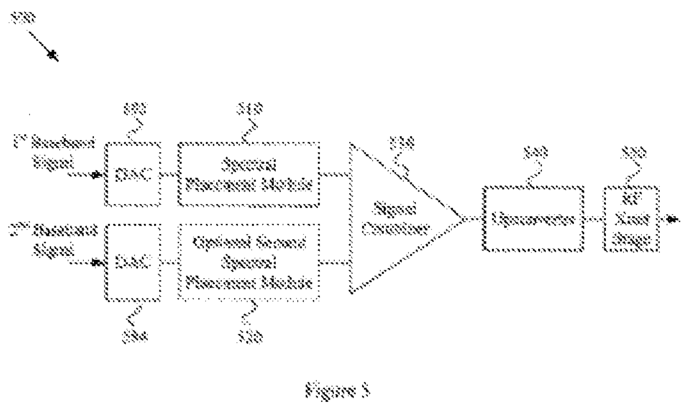


Figure 7

Although not expressly illustrated in FIG. 7 as a digital signal converted to an analog signal, Rofougaran indicates that the first baseband signal could be in the analog and/or digital domain, and that the system may include various ADCs or DACs. See e.g., citations immediately below. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). Rofougaran 5:64-6:4 ("Various components of the exemplary communication system 100 (and other communication systems illustrated and

discussed herein) may be implemented in analog and/or digital circuitry. To illustrate this, the exemplary communication system 100 is not shown with analog-to-digital converters (ADCs) or digital-to-analog converters (DACs). FIGS. 4-6, to be discussed later, show various non-limiting exemplary configurations including such converters.”). In a specific non-limiting example, Rofougaran discloses the first baseband signal converted from digital to analog by the DAC 592. See Rofougaran fig. 5 (1 Baseband Signal):



See Rofougaran 9:30-34 (“[T]he spectral placement module 510, optional second spectral placement module 520 and signal combiner 530 may operate in the analog domain. The first digital-to-analog converter 592 may convert the first baseband signal to the analog domain for processing by the spectral placement module 510”).

the first analog signal carrying the first data across a first frequency range;

Rofougaran discloses the first analog signal (e.g., the first baseband signal in the analog domain) carrying the first data across a first frequency range (e.g., frequency spectrum 203 for the first baseband signal illustrated in FIG. 2). See Rofougaran 10:18-22 (“The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously.”).

See Rofougaran Fig. 2 (illustrating frequency spectrum 203 for first baseband signal):

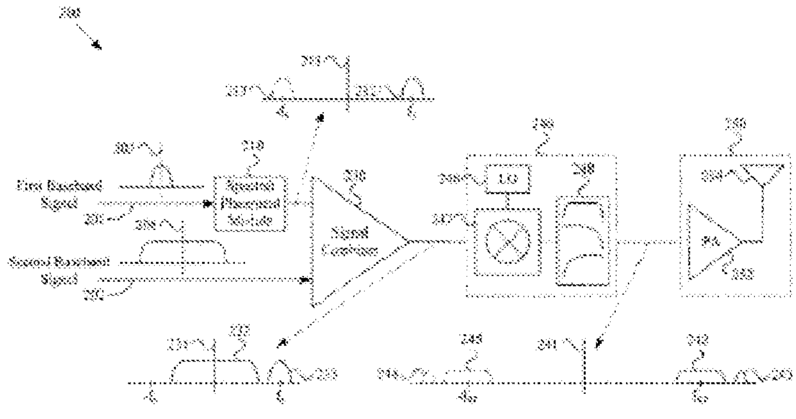


Figure 2

See also Rofougaran 6:12-20 ("The exemplary communication system 200 may comprise at least a first input 201 adapted to receive a first baseband signal. The first baseband signal may, for example, correspond to a first communication protocol (e.g., any of a variety of wireless communication protocols and/or standards). For example and without limitation, the first baseband signal may correspond to the Bluetooth communication protocol. FIG. 2 shows an exemplary frequency spectrum 203 associated with the first baseband signal."). Therefore, the DAC 592 converts the first baseband signal to the analog domain, and this converted analog signal has a spectrum (i.e., frequency range) similar to the spectrum 203.

converting the second digital signal into a second analog signal using a second digital-to-analog converter,

Rofougaran discloses converting the second digital signal (e.g., second baseband signal) into a second analog signal (e.g., second baseband signal in analog domain) using a second digital-to-analog converter (e.g., DAC 594 from FIG. 5).

See Rofougaran fic 7 (second baseband signal).

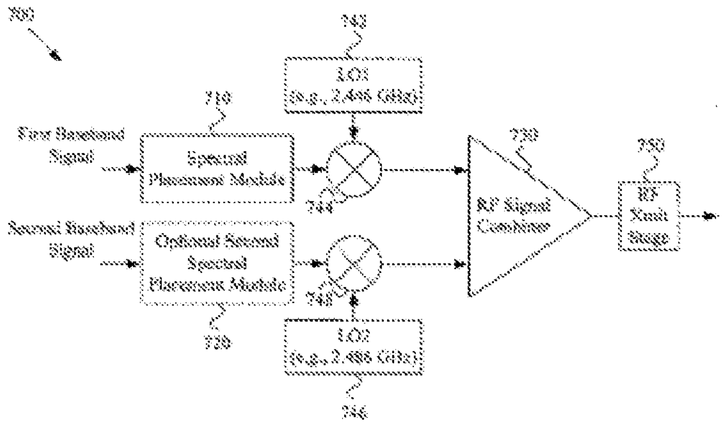


Figure 7

Although not expressly illustrated in FIG. 7 as a digital signal converted to an analog signal, Rofougaran indicates that the second baseband signal could be in the analog and/or digital domain, and that the system may include various ADCs or DACs. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). Rofougaran 5:64-6:4 ("Various components of the exemplary communication system 100 (and other communication systems illustrated and discussed herein) may be implemented in analog and/or digital circuitry. To illustrate this, the exemplary communication system 100 is not shown with analog-to-digital converters (ADCs) or digital-to-analog converters (DACs). FIGS. 4-6, to be discussed later, show various non-limiting exemplary configurations including such converters."). In a specific non-limiting example, Rofougaran discloses the second baseband signal converted from digital to analog by the DAC 594. See Rofougaran fig. 5 (2nd Baseband Signal):

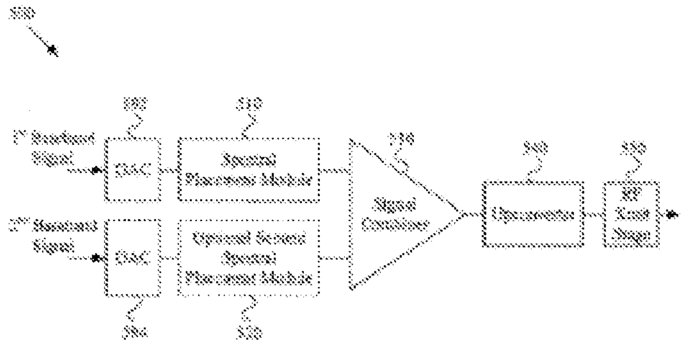


Figure 5

See Rofougaran 9:30-38 (“[T]he spectral placement module 510, optional second spectral placement module 520 and signal combiner 530 may operate in the analog domain. ... The second digital-to-analog converter 594 may convert the second baseband signal to the analog domain for processing by the second spectral placement module 520 or signal combiner 530.”).

the second analog signal carrying the second data across a second frequency range;

Rofougaran discloses the second analog signal (e.g., the second baseband signal in the analog domain) carrying the second data across a second frequency range (e.g., frequency spectrum 204 for the second baseband signal illustrated in FIG. 2). See Rofougaran 10:18-22 (“The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously.”).

See Rofougaran fig. 2 (illustrating frequency spectrum 204 for second baseband signal):

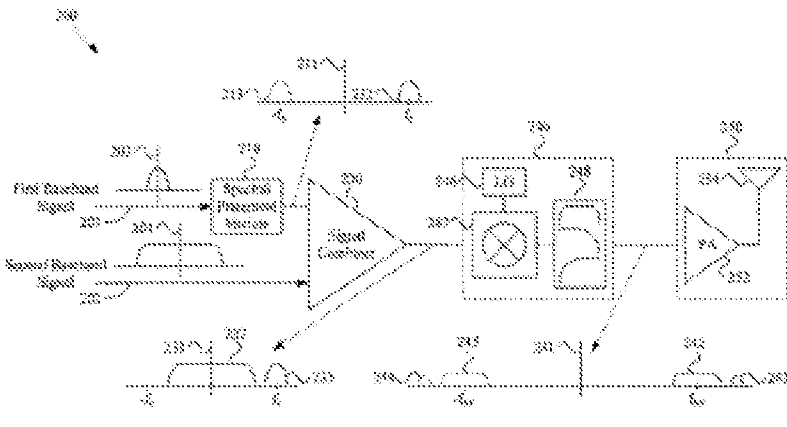


Figure 2

See also Rofougaran 6:21-31 ("The exemplary communication system 200 may also comprise at least a second input 202 adapted to receive a second baseband signal. The second baseband signal may, for example, correspond to a second communication protocol (e.g., a second communication protocol different from the first communication protocol discussed above). For example and without limitation, the first baseband signal may correspond to an IEEE 802.11 communication protocol (e.g., IEEE 802.11(b) or IEEE 802.11(g)). FIG. 2 shows an exemplary frequency spectrum 204 associated with the second baseband signal.").

Therefore, the DAC 594 converts the second baseband signal to the analog domain, and this converted analog signal has a spectrum (i.e., frequency range) similar to the spectrum 204.

up-converting the first analog signal to a first RF center frequency to produce a first up-converted analog signal,

Rofougaran discloses up-converting the first analog signal (e.g., 1st baseband signal in the analog domain) to a first RF center frequency (e.g., local oscillator 742 at 2.446 GHz) to produce a first up-converted analog signal (e.g., output of the mixer 744; or first portion 243 of RF signal formed by upconverter 240 of FIG. 2). See Rofougaran fig. 7 (mixer 744 with local oscillator 742 at RE center frequency 7 446 GHz).

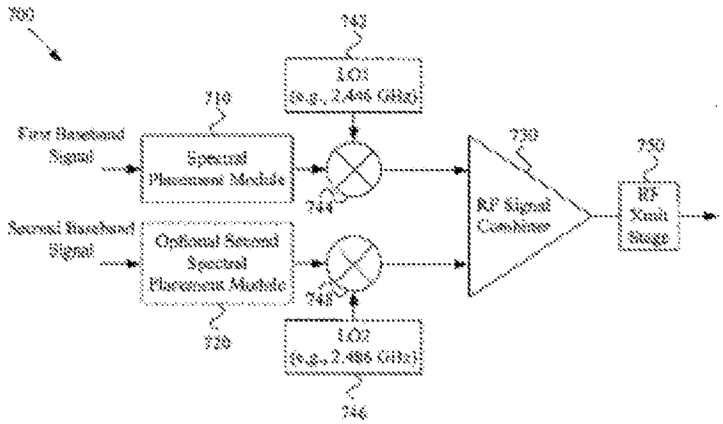


Figure 7

See Rofougaran 10:23-28 ("The exemplary communication system 700 may comprise a first mixer 744 that receives a spectrally shifted first baseband signal from the spectral placement module 710 and a first RF mixing signal (e.g., a 2.446 GHz signal generally associated with the Bluetooth communication protocol) from a first local oscillator 742."). A mixer as shown in FIG. 7 upconverts a baseband signal (here the first baseband signal, which may be shifted by the spectral placement module or not) to be centered on the frequency provided by the local oscillator, here 2.446 GHz. (See Lanning Dec. ¶ 155). FIG. 2 illustrates signal spectrum for various baseband signals, shifted signals, and RF signals, which are also applicable to the system 700. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). As shown in FIG. 2, the first baseband signal has a spectrum 203. This spectrum 203 is shifted by the spectral placement module 210, and then up-converted to the radio frequency f_{RF} by the mixer 247. The spectrum is included in an up-converted analog signal as portion 243 of the RF signal spectrum 241.

See Rofougaran fig. 2 (first portion 243 of RF signal formed by upconverter 240):

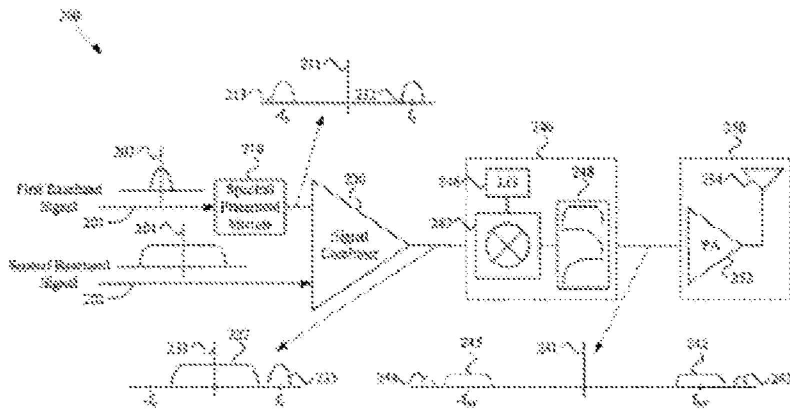


Figure 2

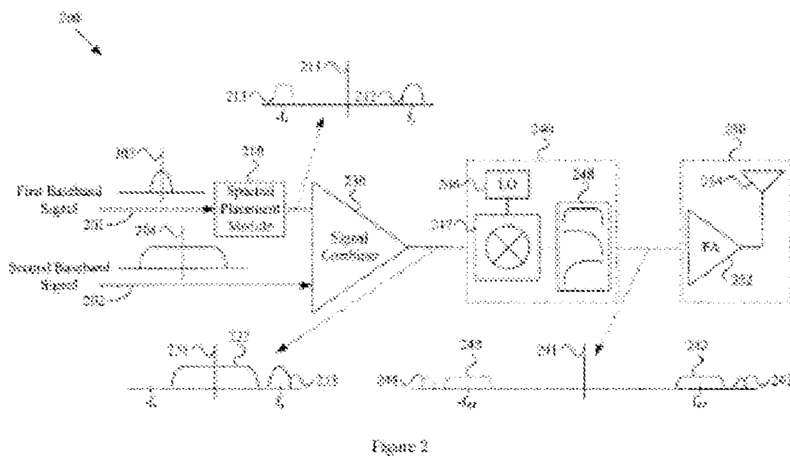
Rofougaran 7:25-34 ("The upconverter 240 may, for example, comprise a mixer 247, a local oscillator 246 and one or more filters 248. The mixer 247 may, for example, receive the composite signal from the signal combiner 230 and an RF mixing signal at frequency f_{RF} from a local oscillator 246. The upconverter 240 may, for example, filter the upconverted signal from the mixer 247 with one or more filters 248. The output of the upconverter 240 may, for example, comprise a signal indicative of the composite signal spectrally shifted to an RF frequency."). Rofougaran 7:35-42 ("FIG. 2 shows an exemplary frequency spectrum 241 associated with the RF signal formed by the upconverter 240. The frequency spectrum 241 comprises a first portion 243 corresponding to the first signal component and a second portion 242 corresponding to the second signal component. Note that the first portion 243 occupies a frequency space (e.g., one or more frequency bands) that is distinct from the frequency space occupied by the second portion 242."). Note that FIG. 2 also shows a first mirror portion 244 that might also be formed by the mixer 247. The first mirror portion 244 may be removed (e.g., filtered out). Rofougaran 7:42-46. Thus, the first portion 243 of the frequency spectrum 241, which is an upshifted signal based on the first baseband signal 203 illustrates a first up-converted analog signal.

wherein the first up-converted analog signal comprises a first up-converted frequency range from the first RF center frequency minus one-half the first

frequency range to the first RF center frequency plus one-half the first frequency range;

Rofougaran discloses wherein the first up-converted analog signal (e.g., output of the mixer 744) comprises a first up- converted frequency range (e.g., a distinct frequency band) from the first RF center frequency (e.g., 2.446 GHz) minus one-half the first frequency range (e.g., one half of frequency range of first baseband signal) to the first RF center frequency (e.g., 2.446 GHz) plus one-half the first frequency range (e.g., one half of frequency range of first baseband signal; in other words, the first up-converted frequency range has the same width as the first frequency range of the first baseband signal and is symmetrical about the local oscillator 742 frequency at 2.446 GHz). Rofougaran 10:23-28 ("The exemplary communication system 700 may comprise a first mixer 744 that receives a spectrally shifted first baseband signal from the spectral placement module 710 and a first RF mixing signal (e.g., a 2.446 GHz signal generally associated with the Bluetooth communication protocol) from a first local oscillator 742."). As explained in Lanning Dec. ¶ 168, a mixer is a well-known component that shifts an input signal to a different frequency range by mixing with another local oscillator frequency. The output signal has the same range between highest and lowest frequency but shifted to be centered on the local oscillator frequency. Therefore, because the mixer 744 mixes the spectrally shifted first baseband signal and the first RF mixing signal, the first up-converted analog output signal has the same bandwidth as the first baseband signal. FIG. 2 illustrates signal spectrum for various baseband signals, shifted signals, and RF signals, which are also applicable to the system 700. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). As shown in FIG. 2, the first baseband signal is included in an up-converted analog signal as portion 243 of the RF signal spectrum 241.

This portion 243 is centered on a center frequency. See Rofougaran fig. 2 (first portion 243 has a frequency range that extends with 1/2 of the frequency range below its center frequency and 1/2 of the frequency range above its center frequency). (Note that first mirror portion 244 also corresponds to output of mixer 240, but may be filtered or otherwise removed.)



Rofougaran 7:25-34 ("The upconverter 240 may, for example, comprise a mixer 247, a local oscillator 246 and one or more filters 248. The mixer 247 may, for example, receive the composite signal from the signal combiner 230 and an RF mixing signal at frequency f_{RF} from a local oscillator 246. The upconverter 240 may, for example, filter the upconverted signal from the mixer 247 with one or more filters 248. The output of the upconverter 240 may, for example, comprise a signal indicative of the composite signal spectrally shifted to an RF frequency."). Rofougaran 7:35-42 ("FIG. 2 shows an exemplary frequency spectrum 241 associated with the RF signal formed by the upconverter 240. The frequency spectrum 241 comprises a first portion 243 corresponding to the first signal component and a second portion 242 corresponding to the second signal component. Note that the first portion 243 occupies a frequency space (e.g., one or more frequency bands) that is distinct from the frequency space occupied by the second portion 242."). Rofougaran further discloses that the "first signal component [is] based on the spectrally shifted first baseband signal." Rofougaran 7:7-8. Therefore, because the first signal component is

generated by "shifting" the spectrum 203, this component has the same frequency range as the spectrum 203. Thus, the upconverted spectrum portion 243 corresponding to the first baseband signal is a distinct frequency band, and thus has a finite frequency range, which is illustrated as the width of the portion 243 in FIG. 2, which is the same as the width of the first baseband signal spectrum 203. The up-conversion is performed by a mixer 247, and is thus symmetric. In the illustrative example of FIG. 2, the first baseband signal is shifted by fs, so the center frequency of the portion 243 is $f_{RF} + f_s$). Thus, as shown in FIG. 2, the portion 243 extends from the RF center frequency (i.e., $f_{RF} + f_s$) minus one half of the frequency range to the RF center frequency (i.e., $f_{RF} + f_s$) plus one half of the frequency range.

up-converting the second analog signal to a second RF center frequency greater than the first center RF frequency to produce a second up-converted analog signal,

Rofougaran discloses up-converting the second analog signal (e.g., 2" baseband signal in the analog domain) to a second RF center frequency (e.g., local oscillator 746 at 2.486 GHz) greater than the first center RF frequency (e.g., local oscillator 742 at 2.446 GHz) to produce a second up-converted analog signal (e.g., output of the mixer 748; or second portion 242 of RF signal formed by upconverter 240 of FIG. 2). See Rofougaran fig. 7 (mixer 748 with local oscillator 746 at RF center frequency 2.486 GHz, which is greater than LO1 742 frequency of 2.446 GHz).

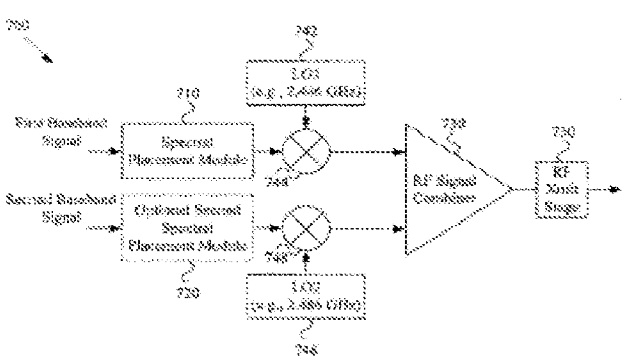


Figure 7

See Rofougaran 10:28-34 ("The exemplary communication system 700 may also comprise a second mixer 748 that receives a second baseband signal (or a spectrally shifted second baseband signal) and a second RF mixing signal (e.g., a 2.486 GHz signal generally associated with the IEEE 802.11(g) communication protocol) from a second local oscillator 746."). A mixer as shown in FIG. 7 upconverts a baseband signal (here the second baseband signal) to be centered on the frequency provided by the local oscillator, here 2.486 GHz. (See Lanning Dec., ¶ 156). FIG. 2 illustrates signal spectrum for various baseband signals, shifted signals, and RF signals, which are also applicable to the system 700. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). As shown in FIG. 2, the second baseband signal has a spectrum 204. This spectrum 204 is not shifted before being up- converted to the radio frequency f_{RF} by the mixer 247. The spectrum is included in an up-converted analog signal as portion 242 of the RF signal spectrum 241. See Rofougaran fig. 2 (second portion 242 of RF signal formed by upconverter 240):

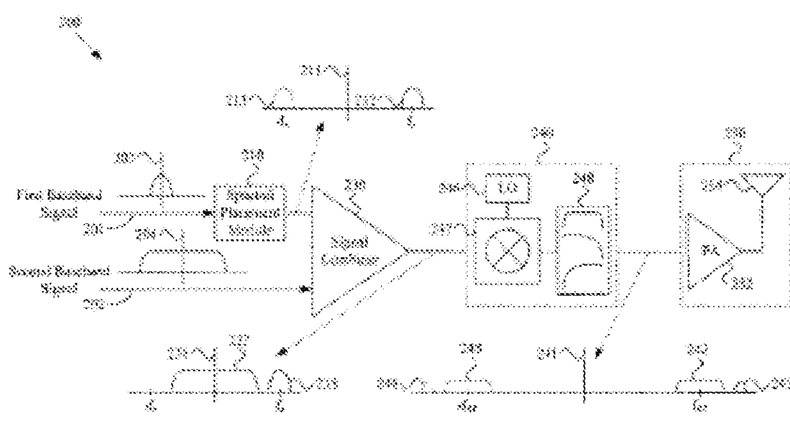


Figure 2

Note that in FIG. 2, the second portion 242 corresponding to the second baseband signal 204 does not have a center frequency greater than the center frequency of the first portion 243. This

is due to the use of the spectral placement module 210 on the first baseband signal in FIG. 2, which results in an increased center frequency for the first portion 243. In contrast, the example shown in FIG. 7 uses two separate mixers 744, 748 with different LO frequencies 742, 746 such that the second RF center frequency is greater than the first RF center frequency. The same result would be achieved using the system of FIG. 2, for example, by spectrally shifting the second baseband signal instead of the first baseband signal, as described at Rofougaran 4:48-67.

Rofougaran 7:25-34 ("The upconverter 240 may, for example, comprise a mixer 247, a local oscillator 246 and one or more filters 248. The mixer 247 may, for example, receive the composite signal from the signal combiner 230 and an RF mixing signal at frequency f_{RF} from a local oscillator 246. The upconverter 240 may, for example, filter the upconverted signal from the mixer 247 with one or more filters 248. The output of the upconverter 240 may, for example, comprise a signal indicative of the composite signal spectrally shifted to an RF frequency."). Rofougaran 7:35-42 ("FIG. 2 shows an exemplary frequency spectrum 241 associated with the RF signal formed by the upconverter 240. The frequency spectrum 241 comprises a first portion 243 corresponding to the first signal component and a second portion 242 corresponding to the second signal component. Note that the first portion 243 occupies a frequency space (e.g., one or more frequency bands) that is distinct from the frequency space occupied by the second portion 242."). Note that FIG. 2 also shows a second mirror portion 245 that might also be formed by the mixer 247. The second mirror portion 245 may be removed (e.g., filtered out). Rofougaran 7:42-46, Thus, the second portion 242 of the frequency spectrum 241, which is an upshifted signal based on the second baseband signal 204 illustrates a second un-converted analog signal.

> **wherein the second up-converted analog signal comprises a second up-converted frequency range from the second RF center frequency minus one-half the second frequency range to the second RF center frequency plus one-half the second frequency range, and**

Rofougaran discloses wherein the second up-converted analog signal (e.g., output of the mixer 748) comprises a second up- converted frequency range (e.g., a distinct frequency band) from the second RF center frequency (e.g., 2.486 GHz) minus one-half the second frequency range (¢.g., one half of frequency range of second baseband signal) to the second RF center frequency (e.g., 2.486 GHz) plus one-half the first frequency range (e.g., one half of frequency range of second baseband signal; in other words, the second up-converted frequency range has the same width as the second frequency range of the second baseband signal and is symmetrical about the local oscillator 748 frequency at 2.486 GHz). See Rofougaran 10:28-34 (“The exemplary communication system 700 may also comprise a second mixer 748 that receives a second baseband signal (or a spectrally shifted second baseband signal) and a second RF mixing signal (e.g., a 2.486 GHz signal generally associated with the IEEE 802.11(g) communication protocol) from a second local oscillator 746.”). Therefore, because the mixer 748 mixes the second baseband signal and the second RF mixing signal, the second up- converted analog output signal has the same bandwidth as the second baseband signal. FIG. 2 illustrates signal spectrum for various baseband signals, shifted signals, and RF signals, which are also applicable to the system 700. See Rofougaran 10:18-22 (“The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously.”). As shown in FIG. 2, the second baseband signal is included in an up-converted analog signal as portion 242 of the RF signal spectrum 241. This portion 242 is centered on a center frequency f_{RF}. See Rofougaran fig. 2 (second portion 242 has a frequency range that extends with ½ of the frequency range below center frequency f_{RF} and ½ of the frequency range above center frequency f_{RF}). (Note that second

mirror portion 245 also corresponds to output of mixer 240, but may be filtered or otherwise removed.)

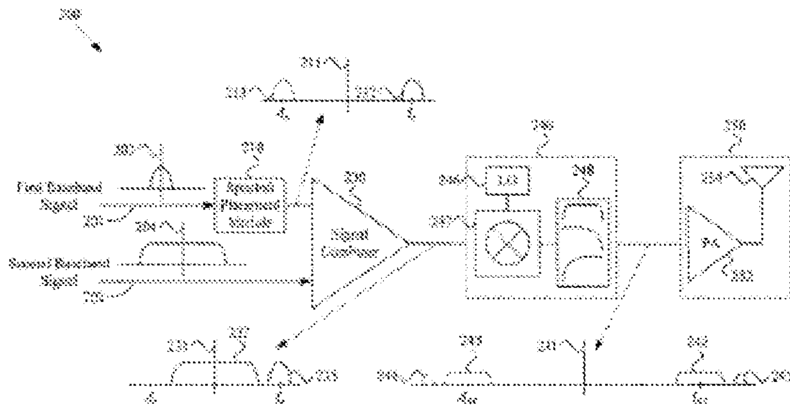


Figure 2

Rofougaran 7:25-34 ("The upconverter 240 may, for example, comprise a mixer 247, a local oscillator 246 and one or more filters 248. The mixer 247 may, for example, receive the composite signal from the signal combiner 230 and an RF mixing signal at frequency f_{RF} from a local oscillator 246. The upconverter 240 may, for example, filter the upconverted signal from the mixer 247 with one or more filters 248. The output of the upconverter 240 may, for example, comprise a signal indicative of the composite signal spectrally shifted to an RF frequency."); Rofougaran 7:35-42 ("FIG. 2 shows an exemplary frequency spectrum 241 associated with the RF signal formed by the upconverter 240. The frequency spectrum 241 comprises a first portion 243 corresponding to the first signal component and a second portion 242 corresponding to the second signal component. Note that the first portion 243 occupies a frequency space (e.g., one or more frequency bands) that is distinct from the frequency space occupied by the second portion 242."). Rofougaran further discloses that the "second signal component [is] based on the second baseband signal (e.g., not spectrally shifted)." Rofougaran 7:8-9. Therefore, because the second signal component is generated without spectral shifting the spectrum 204, this component has the same frequency range as the spectrum 204. Thus, the upconverted spectrum portion 242

corresponding to the second baseband signal is a distinct frequency band, and thus has a finite frequency range, which is illustrated as the width of the portion 242 in FIG. 2, which is the same as the width of the second baseband signal spectrum 204. The upconversion is performed by a mixer 247, and is thus symmetric. In the illustrative example of FIG. 2, the second baseband signal is not shifted, so the center frequency of the portion 242 is f_{RF}. Thus, as shown in FIG. 2, the portion 242 extends from the RF center frequency (i.e., far) minus one half of the frequency range to the RF center frequency (i.e., f_{RF}) plus one half of the frequency range.

wherein a frequency difference between the first RF center frequency and the second RF center freq1uency is greater than the sum of one-half the first frequency range and one-half the second frequency range;

Rofougaran discloses wherein a frequency difference (e.g., 40 MHz) between the first RF center frequency (e.g., 2.446 GHz) and the second RF center frequency (e.g., 2.486 GHz) is greater than the sum of one-half the first frequency range and one-half the second frequency range (e.g., the upconverted signals are in distinct frequency bands that do not overlap).

See Rofougaran fig. 7:

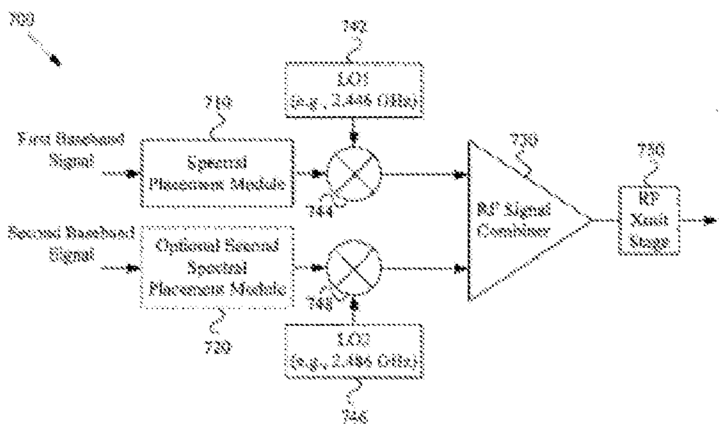


Figure 7

Rofougaran 10:23-28 ("The exemplary communication system 700 may comprise a first mixer 744 that receives a spectrally shifted first baseband signal from the spectral placement module

710 and a first RF mixing signal (e.g., a 2.446 GHz signal generally associated with the Bluetooth communication protocol) from a first local oscillator 742.”). See Rofougaran 10:28-34 (“The exemplary communication system 700 may also comprise a second mixer 748 that receives a second baseband signal (or a spectrally shifted second baseband signal) and a second RF mixing signal (e.g., a 2.486 GHz signal generally associated with the IEEE 802.11(g) communication protocol) from a second local oscillator 746.”). Rofougaran at FIG. 7 doesn’t expressly disclose that the output of the first mixer 744 and the second mixer are in distinct frequency bands, but this is clearly disclosed in other exemplary systems of Rofougaran. See Rofougaran 10:18-22 (“The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously.”).

See Rofougaran fig. 2 (portions 242, 243 of upconverted RF spectrum 241 are distinct and do not overlap).

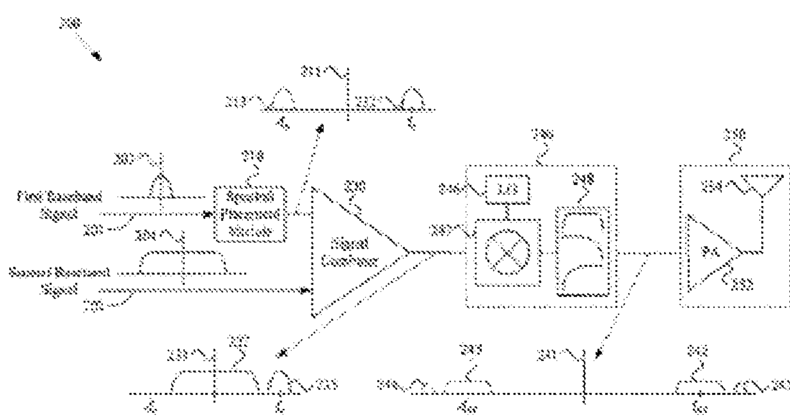


Figure 2

In the example shown in FIG. 2, and corresponding to the example of FIG. 7, the first baseband signal corresponds to a first communication protocol such as Bluetooth, and the second baseband signal corresponds to a second communication protocol such as an IEEE 802.11 protocol. Rofougaran 6:12-31. The upconverted frequency spectrum 241 after the mixer 240 includes two

portions 242, 243 that each occupy distinct frequency bands. Rofougaran 7:35-42 ("FIG. 2 shows an exemplary frequency spectrum 241 associated with the RF signal formed by the upconverter 240. The frequency spectrum 241 comprises a first portion 243 corresponding to the first signal component and a second portion 242 corresponding to the second signal component. Note that the first portion 243 occupies a frequency space (e.g., one or more frequency bands) that is distinct from the frequency space occupied by the second portion 242."). Therefore, because the portions 242, 243 are in distinct frequency bands, the frequency difference between first RF center frequency (e.g., 2.446 GHz for Bluetooth) and the second RF center frequency (e.g., 2.486 GHz for 802.11) is greater than the sum of one-half of the first frequency range (e.g., spectrum portion 243) and one-half of the second frequency range (e.¢.. spectrum portion 242).

combining the first up-converted analog signal and the second up-converted analog signal to produce a combined up-converted signal;

Rofougaran discloses combining the first up-converted analog signal (e.g., output from the mixer 744) and the second up- converted analog signal (e.g., output from the mixer 748) to produce a combined up-converted signal (e.g., output from the RE signal combiner 730).

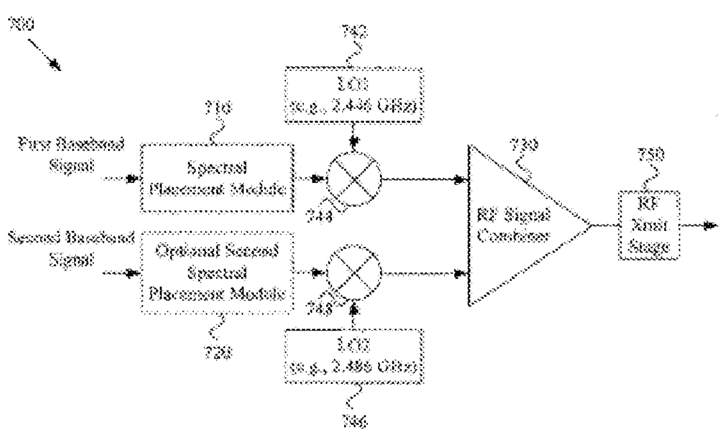


Figure 7

Rofougaran 10:35-40 ("The exemplary communication system 700 may comprise an RF signal combiner 730 that is adapted to combine input RF signals. The RF signal combiner 730 may, for example, receive and combine the output signals from the first mixer 744 and second mixer 748 to generate an RF composite signal."') Although FIG. 7 does not illustrate the combined up-converted signal (e.g., the RF composite signal output from the RF signal combiner 730 of FIG. 7), FIG. 2 of Rofougaran does illustrate a spectrum 241 of a composite, up-converted signal. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). As shown in FIG. 2, the spectrum 241 shows output after processing by the upconverter 240 and the signal combiner 230. The spectrum 241 includes first portion 243 (corresponding to the first baseband signal) and second portion 242 (corresponding to the second baseband signal). Note that the spectrum 241 also illustrates first mirror portion 244 and second mirror portion 245, which are created by the mixer 247 but may be removed from the spectrum 241. Rofougaran 7:42-46.

Rofougaran 7:26-29 ("The mixer 247 may, for example, receive the composite signal from the signal combiner 230 and an RF mixing signal at frequency f_{RF} from a local oscillator 246."). Rofougaran 7:35-42 ("FIG. 2 shows an exemplary frequency spectrum 241 associated with the RF signal formed by the upconverter 240. The frequency spectrum 241 comprises a first portion 243 corresponding to the first signal component and a second portion 242 corresponding to the second signal component. Note that the first portion 243 occupies a frequency space (e.g., one or more frequency bands) that is distinct from the frequency space occupied by the second portion 242. ").

amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal; and

Rofougaran discloses amplifying the combined up-converted signal (e.g., output from the RF signal combiner 730) in a power amplifier (e.g., RF transmission stage 750) resulting in an amplified combined up-converted signal (e.g., output from RF transmission stage 750).

See Rofougaran fig. 7 (RF transmission stage 750).

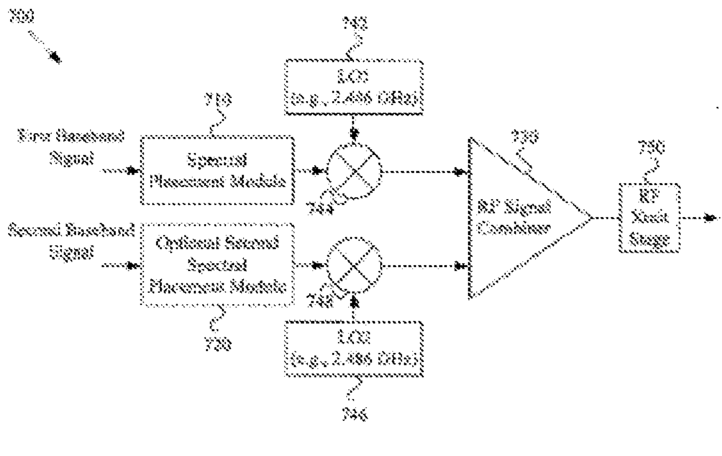


Figure 7

See Rofougaran 10:40-43 (“The exemplary communication system 700 may also comprise a RF transmission stage 750 that receives the RF composite signal from the RF signal combiner 730 and transmit the signal.”). Although FIG. 7 does not expressly illustrate a power amplifier in the RF transmission stage 750;, the RF transmission stage 250 shown in FIG. 2 does include a power amplifier 252. See Rofougaran 10:18-22 (“The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously.”). Therefore, the transmission stage 750 includes a power amplifier. See Rofougaran fig. 2 (power amplifier 252).

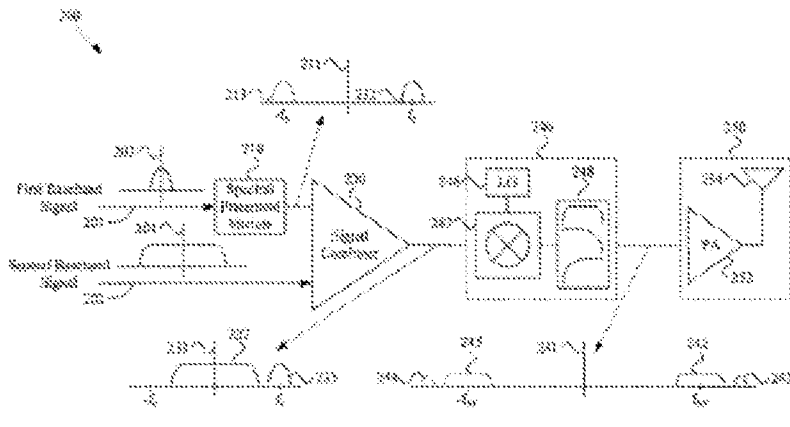


Figure 2

Rofougaran 7:47-57 ("The exemplary communication system 200 may further comprise a RF transmission stage 250 adapted to transmit an RF signal.... Such an RF signal may, for example, be associated with the composite signal output from the signal combiner 230 and upconverted by the upconverter 240. The RF transmission stage 250 may, for example and without limitation, comprise a power amplifier 252, antenna 254 and other components generally associated with RF signal transmission.").

transmitting the amplified combined up-converted signal on a first antenna,

Rofougaran discloses transmitting the amplified combined up- converted signal (e.g., output from the RF transmission stage 750) on a first antenna (e.g., antenna 254 shown in FIG. 2). See Rofougaran fig. 7 (RF transmission stage 750).

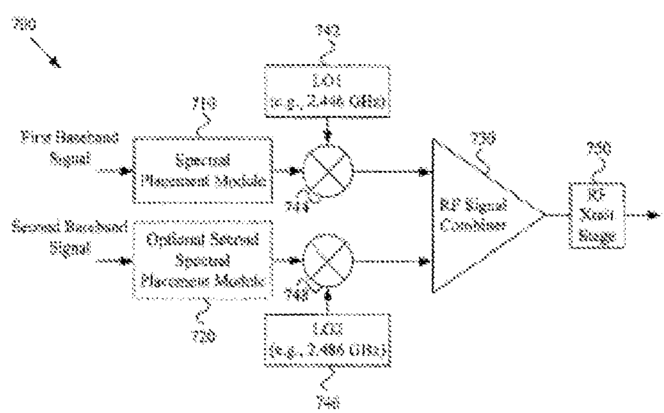


Figure 7

See Rofougaran 10:40-43 ("The exemplary communication system 700 may also comprise a RF transmission stage 750 that receives the RF composite signal from the RF signal combiner 730 and transmit the signal."). Although the RF transmission stage 750 is not expressly illustrated with an antenna, the RF transmission stage 250 shown in FIG. 2 includes an antenna 254. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). See also Rofougaran fig. 2 (antenna 254).

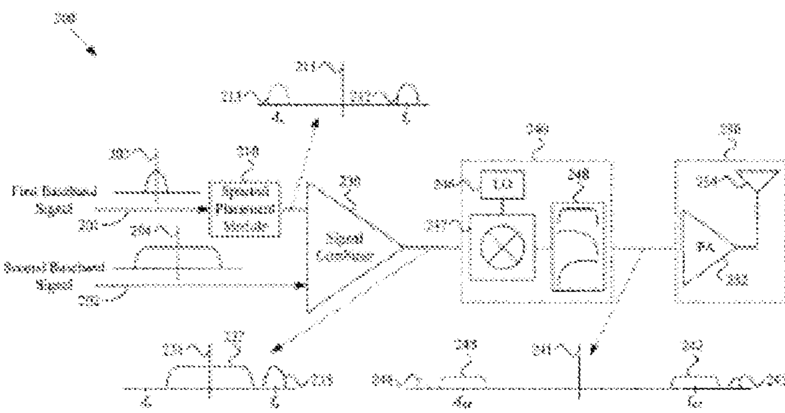


Figure 2

Rofougaran 7:47-57 ("The exemplary communication system 200 may further comprise a RF transmission stage 250 adapted to transmit an RF signal.... Such an RF signal may, for example, be associated with the composite signal output from the signal combiner 230 and upconverted by the upconverter 240. The RF transmission stage 250 may, for example and without limitation, comprise a power amplifier 252, antenna 254 and other components generally associated with RF signal transmission.").

> **wherein the bandwidth of said power amplifier is greater than the difference between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range.**

Rofougaran discloses wherein the bandwidth of said power amplifier (e.g., RF transmission stage 750) is greater than the difference between a lowest frequency in the first up-

converted frequency range and a highest frequency in the second up- converted frequency range.

If it is determined that Rofougaran does not explicitly or impliedly disclose claim [10.10], then Rofougaran combined with Jäntti discloses wherein the bandwidth of said power amplifier (e.g., multi-frequency PA 306 of Jäntti) is greater than the difference between a lowest frequency in the first up- converted frequency range and a highest frequency in the second up-converted frequency range as applied to Rofougaran. See Rofougaran 10:40-43 ("The exemplary communication system 700 may also comprise a RF transmission stage 750 that receives the RF composite signal from the RF signal combiner 730 and transmit the signal."). Because Rofougaran discloses amplifying the RF composite signal with the RF transmission stage 750, it also discloses that the RF transmission stage 750 has bandwidth of at least the bandwidth of the entire RF composite signal (i.e., the difference between the lowest and the highest frequencies of the respective signals). FIG. 2 of Rofougaran also discloses a power amplifier, and illustrates amplifying an upshifted composite signal 241. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). See Rofougaran fig. 2 (PA 252 amplifies upshifted composite signal 241).

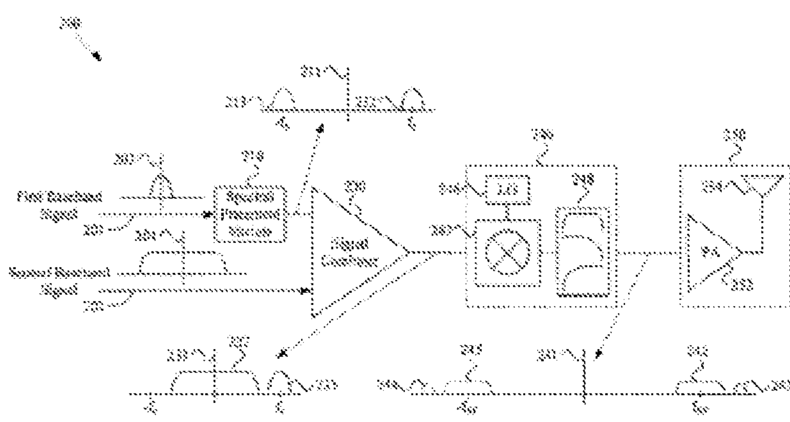


Figure 2

Rofougaran 7:31-34 ("The output of the upconverter 240 may, for example, comprise a signal indicative of the composite signal spectrally shifted to an RF frequency."). Rofougaran 7:35-42 ("FIG. 2 shows an exemplary frequency spectrum 241 associated with the RF signal formed by the upconverter 240. The frequency spectrum 241 comprises a first portion 243 corresponding to the first signal component and a second portion 242 corresponding to the second signal component. Note that the first portion 243 occupies a frequency space (e.g., one or more frequency bands) that is distinct from the frequency space occupied by the second portion 242."). Rofougaran 7:47-57 ("The exemplary communication system 200 may further comprise a RF transmission stage 250 adapted to transmit an RF signal.... Such an RF signal may, for example, be associated with the composite signal output from the signal combiner 230 and upconverted by the upconverter 240. The RF transmission stage 250 may, for example and without limitation, comprise a power amplifier 252, antenna 254 and other components generally associated with RF signal transmission."). Therefore, because the PA 252 of Rofougaran amplifies the upconverted frequency spectrum 241, which includes both parts 242, 243, it must have bandwidth to cover the entire frequency spectrum 241, including at least the difference between the lowest frequency and the highest frequency of the respective portions 242, 243. Rofougaran also discloses frequency hopping of its baseband signals. Accordingly, initial signals having initial frequency range are hopped to additional frequency ranges, and yet are amplified by the same power amplifier. Thus, Rofougaran discloses its power amplifier having a greater than the difference between the lowest initial frequency range and the highest initial frequency range, at least by its multiple hopped frequency ranges, (see Lanning Dec. ¶ 172). See Rofougaran 4:16-27 ("The exemplary communication system 100 may also comprise a second spectral placement

module 120.... Also for example, in such an exemplary configuration, either or both of the first and second baseband signals may be frequency hopped.”).

Additionally or alternatively, Jäntti further discloses, or at least renders obvious, the bandwidth of said power amplifier (e.g., multifrequency PA 306) is greater than the difference between a lowest frequency in the first up-converted frequency range (e.g., one of multiple frequency ranges or frequency bands for a carrier frequency) and a highest frequency in the second up-converted frequency range (e.g., another one of multiple frequency ranges or frequency bands for a carrier frequency). Jäntti Fig. 3 shows two transmitter units 300, 302, an adder 304. and a multi frequency power amplifier 306.

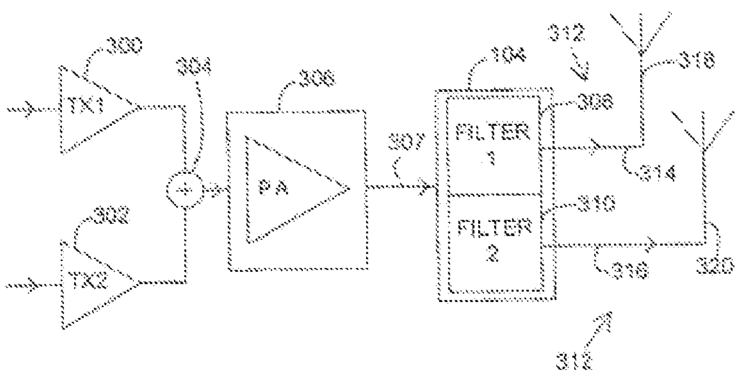


FIG. 3

Jäntti 4:65-67: “[T]wo transmitter units 300, 302 for generating the signals to be transmitted. Said signals generated by the different transmitter units have different frequencies.” Jäntti 5:7-9: “When carriers are at different frequencies, they are typically on entirely different frequency ranges, or frequency bands.”

Jäntti 5:13-15: “[T]he signals having different carrier frequencies and modulated by the transmitter units are combined in an adder in the transmitter block.” Jäntti 5:16-27: “After the combination, the signals are amplified in a multifrequency amplifier [306] acting as the power

amplifier of the amplifier block 102. In a system according to the WCDMA technology, a linear amplifier is used as the power amplifier 306, which enables the simultaneous processing of several signals at different frequencies. Herein, simultaneity means that signals at different frequencies are combined into signals combined with for example the adder 304, as was described above. In a typical case according to the invention, the multifrequency amplifier thus simultaneously amplifies at least two combined signals at different carrier frequencies."

Therefore, the RF transmission stage 750 of Rofougaran as modified by the substitution of the power amplifier of Rofougaran with the multi-frequency power amplifier 306 of Jäntti discloses the bandwidth of said power amplifier is greater than the difference between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range.

Thus, Jäntti discloses that it is advantageous, and therefore obvious to one of ordinary skill in the art, to use a single power amplifier that is capable of simultaneously amplifying different carrier signals on entirely different frequency ranges, each having multiple underlying signals. As applied to Shearer's FIG. 16 example of multiple combined signals, Jäntti reconfirms that a single amplifier having bandwidth greater than Shearer's lowest of 1604 and highest of 1602. Therefore, alternatively, the transceiver 300 of Shearer as modified by the substitution of the HPA 316 of Shearer with the multi-frequency power amplifier 306 of Jäntti discloses the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

Claim 17 is substantially similar to claim 10 and is rejected for similar reasons as stated above.

RE: Claim 13

> **The method of claim 10 wherein the first digital signal is encoded using a first wireless protocol and the second digital signal is encoded using a second wireless protocol.**

Rofougaran discloses wherein the first digital signal (e.g., first baseband signal) is encoded using a first wireless protocol (¢.g., a Bluetooth protocol) and the second digital signal (e.g., second baseband signal) is encoded using a second wireless protocol (e.g., an 802.11(g) protocol). Rofougaran 10:24-27 ("a spectrally shifted first baseband signal from the spectral placement module 710 and a first RF mixing signal (e.g., a 2.446 GHz signal generally associated with the Bluetooth communication protocol"); 10:29-33 ("a second baseband signal (or a spectrally shifted second baseband signal) and a second RF mixing signal (e.g., a 2.486 GHz signal generally associated with the IEEE 802.11(g) communication protocol). Rofougaran also discloses numerous other communication protocols in connection with FIGS. 1-6. See Rofougaran 10:18- 22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). Rofougaran 2:63-3:3 ("A non-limiting list of exemplary communication protocols includes various cellular communication protocols (e.g., GSM, GPRS, EDGE, CDMA, WCDMA, TDMA, PDC, etc.), various wireless networking protocols or standards, including WLAN, WMAN, WPAN and WWAN (e.g., IEEE 802.11, Bluetooth, IEEE 802.15, UWB, IEEE 802.16, IEEE 802.20, Zigbee, any WiFi protocol, etc.), various television communication standards, etc."). Rofougaran 3:9-14 ("The first baseband signal may, for example, correspond to a first communication protocol (e.g., any of a variety of wireless communication protocols and/or standards). For example, and without limitation, the first baseband signal may correspond to any of the previously mentioned communication

protocols.”). Rofougaran 3:17-23 (“The second baseband signal may, for example, correspond to a second communication protocol (e.g., a second communication protocol different from the first communication protocol discussed above). For example and without limitation, the second baseband signal may correspond to any of the previously mentioned communication protocols.”). Rofougaran 5:64-6:4 (“Various components of the exemplary communication system 100 (and other communication systems illustrated and discussed herein) may be implemented in analog and/or digital circuitry. To illustrate this, the exemplary communication system 100 is not shown with analog-to-digital converters (ADCs) or digital-to-analog converters (DACs). FIGS. 4-6, to be discussed later, show various non-limiting exemplary configurations including such converters.”). Thus, each of the baseband signals may be a digital signal corresponding to one of various mentioned communication protocols.

Claim 21 is substantially similar to claim 13 and is rejected for similar reasons as stated above.

RE: Claim 18

The communication system of claim 17 wherein the first RF frequency and the second RF frequency change within the bandwidth of the power amplifier.

Rofougaran discloses wherein the first RF frequency (e.g., LO1 742 frequency) and the second RF frequency (e.g., LO2 746 frequency) change (e.g., adopting a frequency hopping scheme for the first and second baseband signals) within the bandwidth of the power amplifier (e.g., RF transmit stage 730).

See Rofougaran fig. 7 (mixers 744, 748 receiving mixing signals from local oscillators 742, 746).

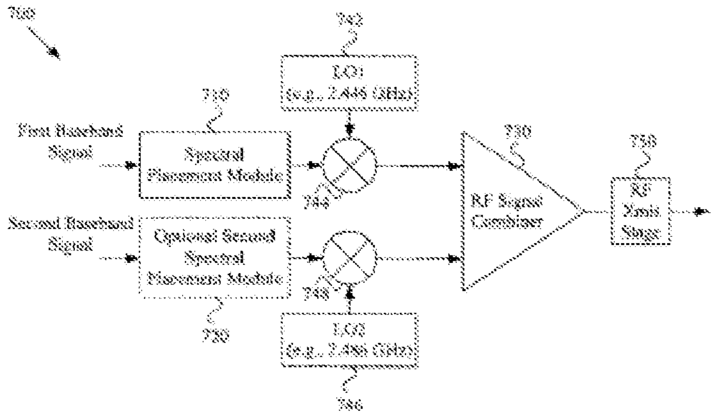


Figure 7

Rofougaran 10:23-28 ("The exemplary communication system 700 may comprise a first mixer 744 that receives a spectrally shifted first baseband signal from the spectral placement module 710 and a first RF mixing signal (e.g., a 2.446 GHz signal generally associated with the Bluetooth communication protocol) from a first local oscillator 742.").

Rofougaran 10:28-34 ("The exemplary communication system 700 may also comprise a second mixer 748 that receives a second baseband signal (or a spectrally shifted second baseband signal) and a second RF mixing signal (e.g., a 2.486 GHz signal generally associated with the IEEE 802.11(g) communication protocol) from a second local oscillator 746."). Although FIG. 7 does not expressly show the LOs 742, 746 changing mixing frequencies, other disclosure in Rofougaran discloses frequency hopping for one or more of the baseband signals, which is applicable to the system 700 of FIG. 7. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). See also Rofougaran 3:50-58 ("In a non-limiting exemplary scenario, the spectral placement module 110 may be adapted to implement a frequency-hopping scheme with the first baseband signal. For example, in a scenario, where there are one or more frequency bands (e.g., a

second frequency space) associated with the second baseband signal, the spectral placement module 110 may be adapted to shift the first baseband signal to numerous consecutive frequency spaces (or bands) that are substantially distinct from the second frequency space."); 4:25-27 ("Also for example, in such an exemplary configuration, either or both of the first and second baseband signals may be frequency hopped."). A "frequency-hopping scheme" as disclosed by Rofougaran includes changing the RF center frequencies and in accordance therewith upconverting to the changed RF center frequencies. Rofougaran also discloses frequency hopping of its baseband signals. Accordingly, initial signals having initial frequency range are hopped to additional frequency ranges, and yet are amplified by the same power amplifier. Thus, Rofougaran discloses its power amplifier having a greater than the difference between the lowest initial frequency range and the highest initial frequency range, at least by its multiple hopped frequency ranges.

RE: Claim 22

> **The communication system of claim 17 wherein the second data corresponds to the first data and wherein the power amplifier outputs a third up-converted signal comprising the up-converted first analog signal and the up-converted second analog signal.**

Rofougaran discloses the system 700 receives a spectrally shifted first baseband signal and a second baseband signal, but does not expressly specify the contents of those signals. See Rofougaran 10:24-30. Other exemplary systems of Rofougaran discloses that the first and second baseband signal may depend on each other. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed

previously.”). Rofougaran 3:24-34 (“The first baseband signal and the second baseband signal may, for example, be generated by one or more modules (i.e., hardware and/or software modules) of the communication system 100. For example, such modules may generate the first and second baseband signals independently (e.g., corresponding to independent respective communications). Alternatively, for example, such modules may generate the first and second baseband signals in a dependent manner (e.g., coordinating independent respective communications or utilizing both the first and second baseband signals for a single communication).”). Therefore, when the first and second baseband signals are generated in a “dependent” manner (e.g., utilized for a single communication), the second data “corresponds to” the first data.

Rofougaran discloses wherein the power amplifier (e.g., RF transmission stage 750) outputs a third up-converted signal (e.g., output from RF transmission stage 750) comprising the up-converted first analog signal and the up-converted second analog signal (e.g., an amplified combined up-converted signal including output from the RF signal combiner 730). See Rofougaran fig. 7 (RF transmission stage 750).

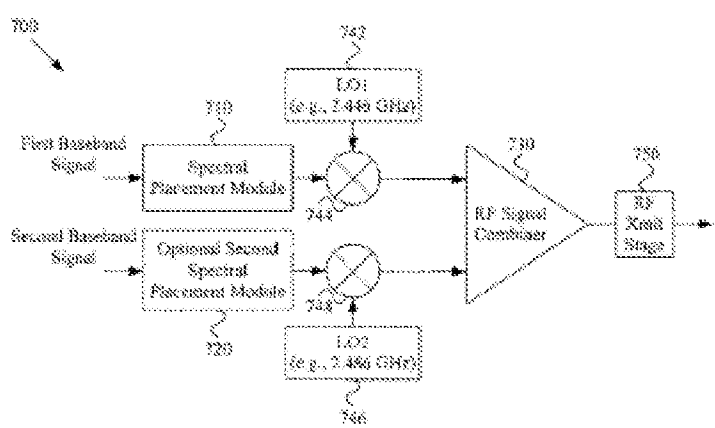
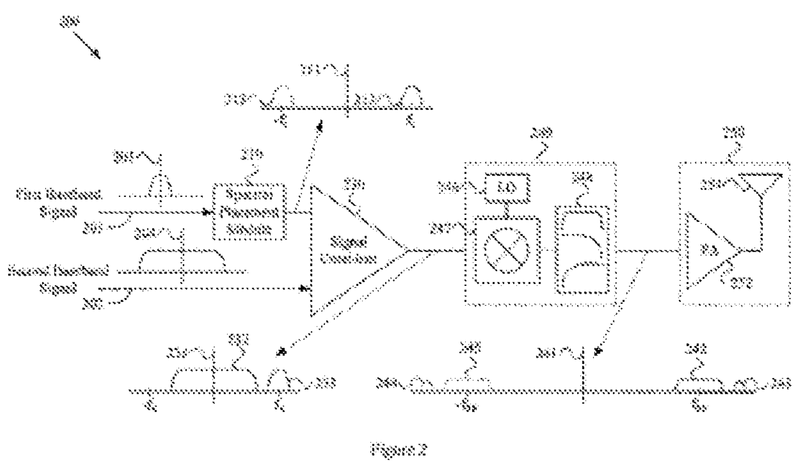


Figure 7

See Rofougaran 10:40-43 ("The exemplary communication system 700 may also comprise a RF transmission stage 750 that receives the RF composite signal from the RF signal combiner 730 and transmit the signal."). Although the RF transmission stage 750 is not illustrated as including a power amplifier, the RF transmission stage 250 shown in FIG. 2 includes a power amplifier 252. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). See also Rofougaran fig. 2 (power amplifier 252).



Rofougaran 7:47-57 ("The exemplary communication system 200 may further comprise a RF transmission stage 250 adapted to transmit an RF signal.... Such an RF signal may, for example, be associated with the composite signal output from the signal combiner 230 and upconverted by the upconverter 240. The RF transmission stage 250 may, for example and without limitation, comprise a power amplifier 252, antenna 254 and other components generally associated with RF signal transmission.'').

6. **Claim(s) 11 and 20 are** rejected under 35 U.S.C. 103(a) as being obvious over Rofougaran and Jäntti, in further view of Rao.

RE: Claim 11

> **The method of claim 10 further comprising changing the first and second RF center frequencies, and in accordance therewith, up-converting the first analog signals to the changed first and second RF center frequencies,**

Rofougaran discloses changing the first and second RF center frequencies, and in accordance therewith, up-converting the first analog signals to the changed first and second RF center frequencies (e.g., adopting a frequency hopping scheme for the first and second baseband signals). See Rofougaran fig. 7 (mixers 744, 748 receiving mixing signals from local oscillators 742, 746).

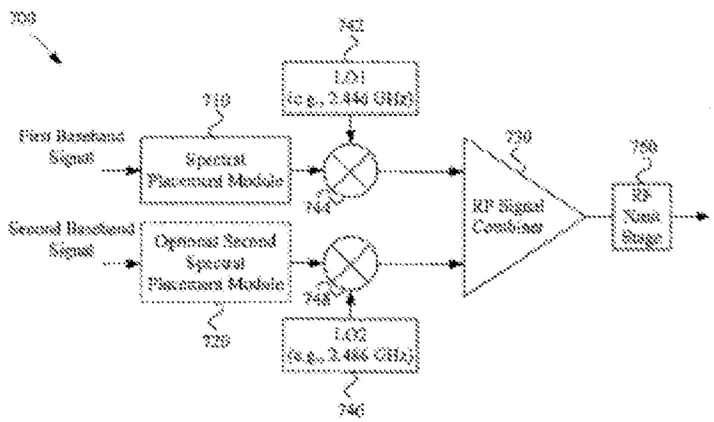


Figure 7

Rofougaran 10:23-28 ("The exemplary communication system 700 may comprise a first mixer 744 that receives a spectrally shifted first baseband signal from the spectral placement module 710 and a first RF mixing signal (e.g., a 2.446 GHz signal generally associated with the Bluetooth communication protocol) from a first local oscillator 742."). Rofougaran 10:28-34 ("The exemplary communication system 700 may also comprise a second mixer 748 that receives a second baseband signal (or a spectrally shifted second baseband signal) and a second RF mixing signal (e.g., a 2.486 GHz signal generally associated with the IEEE 802.11(g) communication protocol) from a second local oscillator 746.").

Although FIG. 7 does not expressly show the LOs 742, 746 changing mixing frequencies, other disclosure in Rofougaran discloses frequency hopping for one or more of the baseband signals, which is applicable to the system 700 of FIG. 7. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). See also Rofougaran 3:50-58 ("In a non-limiting exemplary scenario, the spectral placement module 110 may be adapted to implement a frequency-hopping scheme with the first baseband signal. For example, in a scenario, where there are one or more frequency bands (e.g., a second frequency space) associated with the second baseband signal, the spectral placement module 110 may be adapted to shift the first baseband signal to numerous consecutive frequency spaces (or bands) that are substantially distinct from the second frequency space."); 4:25 - 27 ("Also for example, in such an exemplary configuration, either or both of the first and second baseband signals may be frequency hopped."). A "frequency-hopping scheme" as disclosed by Rofougaran includes changing the RF center frequencies and in accordance therewith upconverting to the changed RF center frequencies.

> **wherein the first RF center frequency changes by at least the first frequency range and the second RF center frequency changes by at least the second frequency range.**

Rofougaran discloses wherein the first RF center frequency changes by at least the first frequency range and the second RF center frequency changes by at least the second frequency range (e.g., the signals are in consecutive, distinct frequency spaces or bands). Although FIG. 7 does not expressly show the LOs 742, 746 changing mixing frequencies, other disclosure in Rofougaran discloses frequency hopping for one or more of the baseband signals, which is applicable to the system 700 of FIG. 7. See Rofougaran 10:18-22 ("The exemplary

communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously.”). Rofougaran 3:55-58 (“[T]he spectral placement module 110 may be adapted to shift the first baseband signal to numerous consecutive frequency spaces (or bands) that are substantially distinct from the second frequency space.”).

Rofougaran 4:16-27 (“The exemplary communication system 100 may also comprise a second spectral placement module 120. ... Also for example, in such an exemplary configuration, either or both of the first and second baseband signals may be frequency hopped.”). The “consecutive frequency spaces (or bands)” of Rofougaran thus require the RF center frequencies to change by at least the respective frequency ranges—otherwise, the frequency bands would overlap. Additionally or alternatively, Rao further discloses, or at least renders obvious, wherein the first RF center frequency changes by at least the first frequency range (e.g., 528 MHz) and the second RF center frequency changes by at least the second frequency range (e.g., 528 MHz), (See Lanning Dec. ¶ 200). Rao at 560, col. 1 (“MB-OFDM signals hop between 14 band center frequencies according to the specified time-frequency code.”). See Rao at 559, col. 1 (“This definition provides a unique numbering system for all channels that have a spacing of 528 MHz and lie within the band 3.1 — 10.6 GHz.”). See also Rao Table 1 (highlighting added). As shown, each band center frequency is separated by 528 MHz (i.e., “at least” the frequency range).

TABLE 1 – OFDM PHY BAND ALLOCATION

Band Group	Band ID	Lower Frequency (MHz)	Center Frequency (MHz)	Upper Frequency (MHz)
1	1	3168	3432	3696
	2	3696	3960	4224
	3	4224	4488	4752
2	4	4752	5016	5280
	5	5280	5544	5808
	6	5808	6072	6336
3	7	6336	6600	6864
	8	6864	7128	7392
	9	7392	7656	7920
4	10	7920	8184	8448
	11	8448	8712	8976
	12	8976	9240	9504
5	13	9504	9768	10032
	14	10032	10296	10560

It would be obvious to combine Rao's band allocation using center frequencies separated by at least the frequency range with the frequency hopping between consecutive frequency spaces of Rofougaran, as a combination of known elements to achieve predictable results. Therefore, the frequency-hopping scheme of Rofougaran as modified for each of the first frequency range and the second frequency range by the frequency band allocation of Rao reaches the first RF center frequency changes by at least the first frequency range and the second RF center frequency changes by at least the second frequency range.

RE: Claim 20

> **The communication system of claim 18 wherein the first RF frequency and the second RF frequency change periodically.**

Rofougaran discloses the first RF frequency and the second RF frequency change periodically (e.g., adopting a frequency hopping scheme for the first and second baseband signals). Although FIG. 7 does not expressly show the LOs 742, 746 changing mixing frequencies, other disclosure in Rofougaran discloses frequency hopping for one or more of the baseband signals, which is applicable to the system 700 of FIG. 7. See Rofougaran 10:18-22

("The exemplary communication system 700 may, for example and without limitation. share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). See also Rofougaran 3:50-58 ("In a non-limiting exemplary scenario, the spectral placement module 110 may be adapted to implement a frequency-hopping scheme with the first baseband signal. For example, in a scenario, where there are one or more frequency bands (e.g., a second frequency space) associated with the second baseband signal, the spectral placement module 110 may be adapted to shift the first baseband signal to numerous consecutive frequency spaces (or bands) that are substantially distinct from the second frequency space."); 4:25-27 ("Also for example, in such an exemplary configuration, either or both of the first and second baseband signals may be frequency hopped."). The "frequency-hopping scheme" of Rofougaran discloses periodically changing the first and second RF frequencies. (See Lanning Dec.¶ 175). Additionally or alternatively, Rao discloses frequency hopping based on a time-frequency code, and the MB-OFDM signals have a "period." Therefore, Rao discloses "periodic" changes to RF frequencies. See Rao at 560, col. 1 (MB-OFDM signals hop between 14 band center frequencies according to the specified time- frequency code."), ("$T_{OFDM} = L\Delta t$ = 312.5 nanoseconds is the MB-OFDM symbol period... ."). Therefore, the frequency-hopping scheme of Rofougaran combined with the time-interleaved frequency hopping of signals with an MB-OFDM symbol period of Rao reaches the first RF frequency and the second RF frequency change periodically.

A POSITA would be motivated to combine the frequency hopping of Rofougaran (and alternatively with Jäntti, as discussed above and incorporated here) with the periodic changes of Rao to generate even levels of transmission power across frequencies and to prevent interference between adjacent frequencies.

7. **Claim(s) 12, 19, and 23 are** rejected under 35 U.S.C. 103(a) as being obvious over Rofougaran and Jäntti, in further view of Shearer.

RE: Claim 12

The method of claim 11 wherein the first and second RF center frequencies are changed concurrently.

Rofougaran and Shearer discloses the first and second RF center frequencies are changed concurrently. Although FIG. 7 of Rofougaran does not expressly show the LOs 742, 746 changing mixing frequencies, other disclosure in Rofougaran discloses frequency hopping for one or more of the baseband signals, which is applicable to the system 700 of FIG. 7. See Rofougaran 10:18-22 ("The exemplary communication system 700 may, for example and without limitation, share any or all characteristics with the exemplary systems 100-600 illustrated in FIGS. 1-6 and discussed previously."). See also Rofougaran 3:50-58 ("In a non-limiting exemplary scenario, the spectral placement module 110 may be adapted to implement a frequency-hopping scheme with the first baseband signal. For example, in a scenario, where there are one or more frequency bands (e.g., a second frequency space) associated with the second baseband signal, the spectral placement module 110 may be adapted to shift the first baseband signal to numerous consecutive frequency spaces (or bands) that are substantially distinct from the second frequency space."); 4:25- 27 ("Also for example, in such an exemplary configuration, either or both of the first and second baseband signals may be frequency hopped."). The "frequency-hopping scheme" of Rofougaran discloses concurrently changing the first and second RF center frequencies so that the signals are in distinct frequency spaces (or bands). (See Lanning Dec. ¶ 174). Additionally or alternatively, Shearer discloses or at least renders obvious "the first and second RF center frequencies are changed concurrently" (e.g.,

disclosing changing signals in multiple frequency bands simultaneously). Shearer at col. 10:32-38 ("Each signal's start time 1902 and end time 1904 is preferably substantially equivalent to eliminate problems with multiple signal acquisition and termination. These problems may include transmitting and receiving simultaneously. By occupying 'both' channels at the same time, simultaneous transmitting and receiving is enabled.").

See also Shearer fig. 19:

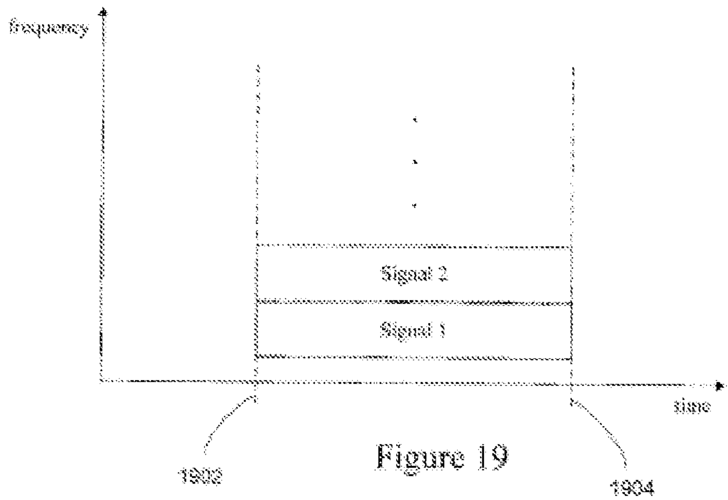


Figure 19

Multiple signals with the same start time 1902 and end time 1904 is the same as changing center frequencies concurrently, because changing center frequencies includes stopping the signals at the RF center frequencies and then starting the signals at the changed RF center frequencies, (See Lanning Dec. ¶ 208). Thus, it would be obvious to modify the frequency "hopping" of Rofougaran such that the center frequencies are changed concurrently so that the signals' start and end times are aligned as in Shearer, in order to prevent problems with signal acquisition and termination. Therefore, the frequency-hopping scheme of Rofougaran combined with using the same start time and end time for both simultaneous channels as in Shearer reaches the first and second RF center frequencies are chanced concurrently.

Claim 19 is substantially similar to claim 12 and is rejected for similar reasons as stated above.

RE: Claim 23

> **The communication system of claim 17 wherein first and second data to be transmitted comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first up-converted frequency range and a second symbol is transmitted during the first time slot across the second up-converted frequency range, and**

Rofougaran does not expressly disclose OFDM symbols. Shearer discloses first and second data to be transmitted comprise a plurality of OFDM symbols (e.g., 802.1 1a input signals) Shearer, e.g., at col. 5:30-33 ("The modulator 312 modulates the encoded data onto carriers in OFDM symbols in accordance with conventional OFDM modulation techniques."). Shearer at col. 8:23-26 ("two 20 MHz 802.11a input signals are received at the PHY unit 300 from FIG. 3 substantially simultaneously. The two signals are processed separately, one in a lower 20 MHz path and one in an upper 20 MHz path."), 9:19-22 ("The output of each path is aggregated in adder 310e to achieve, in this exemplary embodiment, a signal 1400 with a 40 MHz bandwidth and a 40 MHz sample rate as shown in FIG. 14"). A POSITA would understand that combining the communication system of Rofougaran with the OFDM symbols of Shearer would yield predictable results of simultaneous transmission of 802.11a signals, including OFDM symbols. (See Lanning Dec. ¶ 213). Therefore, the transmission of an amplified, combined up- converted signal of Rofougaran combined with simultaneous transmission of two signals including OFDM symbols of Shearer reaches first and second data to be transmitted comprise a plurality of OFDM symbols Rofougaran as modified by Shearer discloses wherein a first symbol (e.g., OFDM symbol) is transmitted during a first time slot (e.g., between start time 1902 and end time 1904) across the first up-converted frequency range (e.g., downshifted signal

1000) and a second symbol (e.g., OFDM symbol) is transmitted during the first time slot (e.g., between start time 1902 and end time 1904) across the second up-converted frequency range (e.g., upshifted signal 1200). Shearer at col. 8:23-26 ("two 20 MHz 802.11a input signals are received at the PHY unit 300 from FIG. 3 substantially simultaneously. The two signals are processed separately, one in a lower 20 MHz path and one in an upper 20 MHz path."), 9:19-22 ("The output of each path is aggregated in adder 310e to achieve, in this exemplary embodiment, a signal 1400 with a 40 MHz bandwidth and a 40 MHz sample rate as shown in FIG. 14"). Shearer at col. 10:32-38 ("Each signal's start time 1902 and end time 1904 is preferably substantially equivalent to eliminate problems with multiple signal acquisition and termination. These problems may include transmitting and receiving simultaneously. By occupying 'both' channels at the same time, simultaneous transmitting and receiving is enabled."), fig. 19.

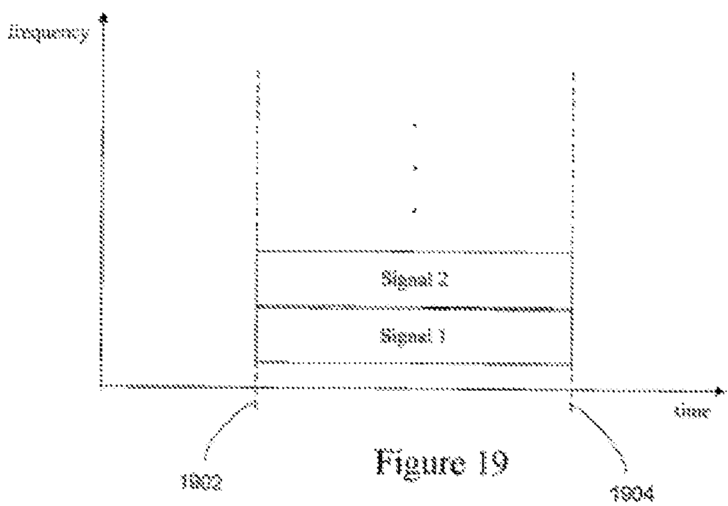


Figure 19

Thus, Shearer discloses transmitting first and second symbols (e.g., OFDM symbols) across first and second frequency ranges (e.g., signals 1000, 1200) during "the first time slot" (e.g., at the same time). Therefore, the transmission of an amplified, combined up- converted signal of Rofougaran combined with using the same start time and end time for both simultaneous channels as in Shearer reaches a first symbol is transmitted during a first time slot across the first

up-converted frequency range and a second symbol is transmitted during the first time slot across the second up-converted frequency range.

> **wherein a third symbol is transmitted during a second time slot across the first up-converted frequency range and a fourth symbol is transmitted during the second time slot across a second up-converted frequency range.**

Rofougaran as modified by Shearer discloses wherein a third symbol (e.g., OFDM symbol) is transmitted during a second time slot (e.g., between start time 1902 and end time 1904) across the first up-converted frequency range (€.g., downshifted signal 1000) and a fourth symbol (e.g., OFDM symbol) is transmitted during the second time slot (e.g., between start time 1902 and end time 1904) across a second up-converted frequency range (e.g., upshifted symbol 1200). Shearer at col. 8:23-26 (“two 20 MHz 802.11a input signals are received at the PHY unit 300 from FIG. 3 substantially simultaneously. The two signals are processed separately, one in a lower 20 MHz path and one in an upper 20 MHz path.”), 9:19-22 (“The output of each path is aggregated in adder 310e to achieve, in this exemplary embodiment, a signal 1400 with a 40 MHz bandwidth and a 40 MHz sample rate as shown in FIG. 14”). Shearer at col. 10:32-38 (“Each signal’s start time 1902 and end time 1904 is preferably substantially equivalent to eliminate problems with multiple signal acquisition and termination. These problems may include transmitting and receiving simultaneously. By occupying ‘both’ channels at the same time, simultaneous transmitting and receiving is enabled.”), fig. 19. Shearer also discloses that data is transmitted as “packets” that include multiple OFDM “data symbols,” and thus discloses transmission of the third symbol and the fourth symbol during a second time slot (different from the first time slot). Shearer illustrates at FIGS. 21-22 “two types of packets, for example for both 20 MHz and 40 MHz.” *Id*. at col. 11:23-24. Each type of packet includes multiple “data symbols.” See, e.g., *Id*. at col. 11:26-29 (mixed-mode packet 2100 with data symbols 2112), col.

11:46-48 (packet 2200 with data symbols 2208). The packets are illustrated in FIGS. 21-22 in sequential order. *Id.* 11:32-35 ("As such, a mixed-mode packet can start with a legacy preamble/ header 2102, 2104, 2106 and then follow with additional extended header/ preamble signal 2108, 9110") 11:46-48 ("As such the packet [2200] begins immediately with an extended preamble/ header 2202, 2204, 2206, followed by data symbols 2208."). Thus, Shearer discloses sending packets with multiple data symbols, which are transmitted sequentially as shown in FIGS. 21-22. Thus, Shearer discloses transmitting third and fourth symbols (e.g., OFDM symbols) across first and second frequency ranges (e.g., signals 1000, 1200) during "the second time slot" (e.g., simultaneously at a different time from the first time slot). Therefore, the transmission of an amplified, combined up- converted signal of Rofougaran combined with using the same start time and end time for both simultaneous channels as in Shearer reaches a third symbol is transmitted during a second time slot across the first up-converted frequency range and a fourth symbol is transmitted during the second time slot across a second up-converted frequency range.

Shearer, in an analogous field, discloses that simultaneously transmitted signals have substantially equivalent start times and end times, and that this eliminates problems with multiple signal acquisition and termination. A POSITA would be motivated to modify the transmission system of Rofougaran (and alternatively with Jäntti, as discussed above and incorporated here) such that first and second symbols in different frequency ranges are transmitted during a first time slot and that third and fourth symbols are transmitted in those frequency ranges during a second time slot so that the resulting symbols have substantially the same start times and end times as disclosed by Shearer, which prevents the problems with multiple signal acquisition and termination described by Shearer.

8. Claim(s) 14 and 15 are rejected under 35 U.S.C. 103(a) as being obvious over Rofougaran and Jäntti, in further view of Balakrshnan and in further view of Zheng.

RE: Claim 14

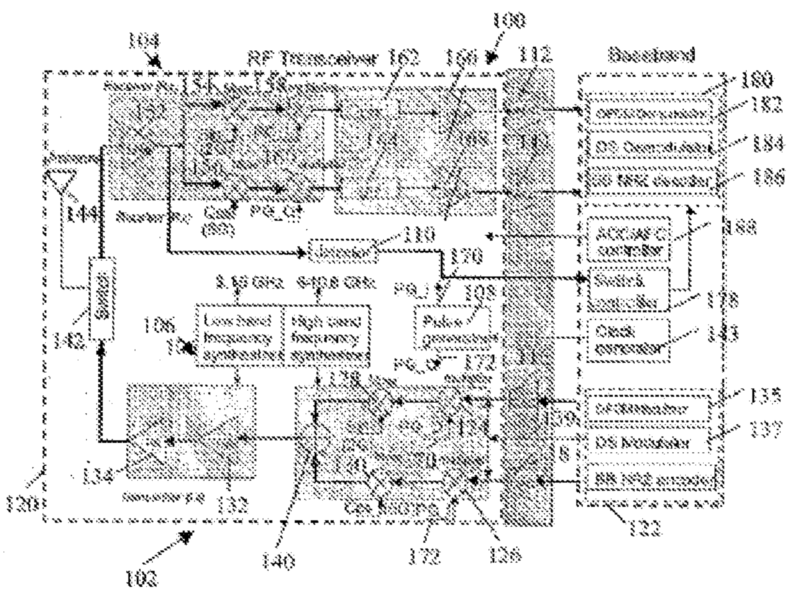
The method of claim 10 wherein the second data is the same as the first data, the method further comprising:

Rofougaran and Balakrishnan renders obvious the second data (e.g., fourth bit stream including every bit of the information bit stream 340) is the same as the first data (e.g., third bit stream including every bit of the information bit stream 340). Balakrishnan ¶ [0029] ("In an embodiment, the bits of an information bit stream 340 may be provided by a higher layer application and are encoded, interleaved, and divided into two parallel bit streams, which may be referred to as two precursor signals, by an encoder/interleaver component 342... . Alternatively, in another embodiment, a third bit stream may contain every bit of the information bit stream 340 and a fourth bit stream may contain every bit of the information bit stream 340 modified in a known way to increase the probability that the combination of the third and fourth bit streams may be correctly demodulated at the receiver 322. The transmission involving duplication of information bit stream 340 may be termed transmit diversity mode."). Therefore, the transmission of an amplified, combined up- converted signal of Rofougaran combined with the transmit diversity mode of Balakrishnan reaches the second data is the same as the first data. termed transmit diversity mode. Therefore, a POSITA would be motivated to combine the transmission of Rofougaran with the transmit diversity mode of Balakrishnan to increase transmission reliability when the received signal power is low and/or when the RF link is

experiencing a high level of interference (noise). The combination of Rofougaran and Balakrishnan discloses the second data is the same as the first data.

receiving the transmitted signal on a second antenna;

Rofougaran does not disclose receiving the transmitted signal. Zheng discloses a transceiver device 100, including receiving the transmitted signal (e.g., UWB signals) on a second antenna (e.g., antenna 144). See Zheng, Fig. 1, Transceiver 100 with antenna 144.

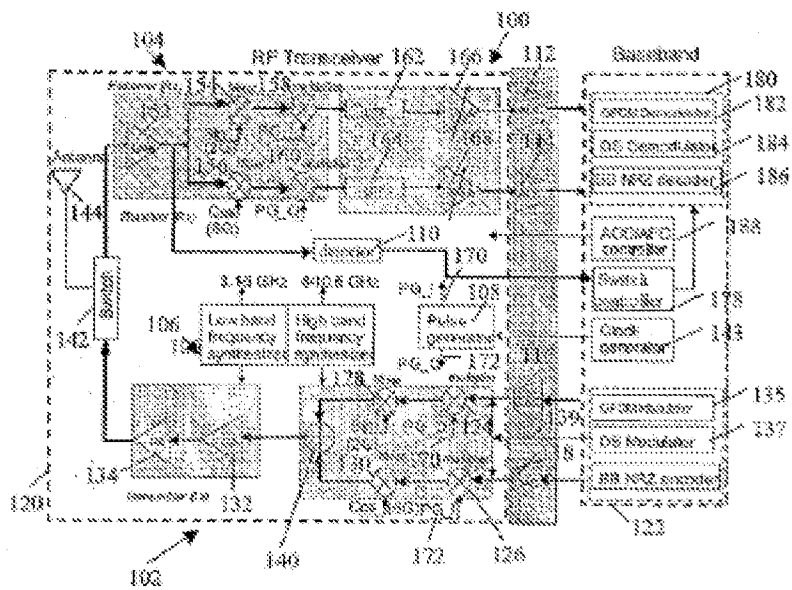


Zheng ¶ [0029] (“The receiver 104 includes one low noise amplifier (LNA) 152, two mixers 154, 156, two multipliers 158, 160, two low pass filters (LPFs) 162, 164, and two variable gain amplifiers (VGAs) 166, 168. The LNA 152 is used to amplifier the received UWB signals from antenna 144. The mixers 154, 156 can be employed to downconvert the different band signals to the baseband. The signal after LNA 152 isa dualband/multiband signal. Since the input LO signals for the two mixers 154, 156 are different, the mixer 154, 156 output signals can be differentiated.”). The claim does not require that the “second antenna” be included in the same device as the transmitting antenna. Thus, the transceiver 100 (including antenna 144) of Zheng combined with the device 700 of Rofougaran reaches “receiving the transmitted signal on

a second antenna." It would be obvious to receive the signals transmitted in claim 10. There is motivation to use the "uniform RF transceiver" of Zheng in order to maximize block utility efficiency and to optimize power consumption. See Zheng ¶ [0024]. (See Lanning Dec. ¶ 229). Therefore, combining transmitting with the transmitter device of Rofougaran with receiving with the RF transceiver 100 of Zheng reaches receiving the transmitted signal on a second antenna.

amplifying the received signal in a low noise amplifier resulting in an amplified received up-converted signal,

Rofougaran as modified by Zheng discloses amplifying the received signal (e.g., UWB signals) in a low noise amplifier (e.g., LNA 152) resulting in an amplified received up-converted signal. See Zheng, Fig. 1, LNA 152.



Zheng ¶ [0029] ("The receiver 104 includes one low noise amplifier (LNA) 152, two mixers 154, 156, two multipliers 158, 160, two low pass filters (LPFs) 162, 164, and two variable gain amplifiers (VGAs) 166, 168. The LNA 152 is used to amplifier the received UWB signals from antenna 144. The mixers 154, 156 can be employed to downconvert the different

band signals to the baseband. The signal after LNA 152 isa dualband/multiband signal. Since the input LO signals for the two mixers 154, 156 are different, the mixer 154, 156 output signals can be differentiated.”).

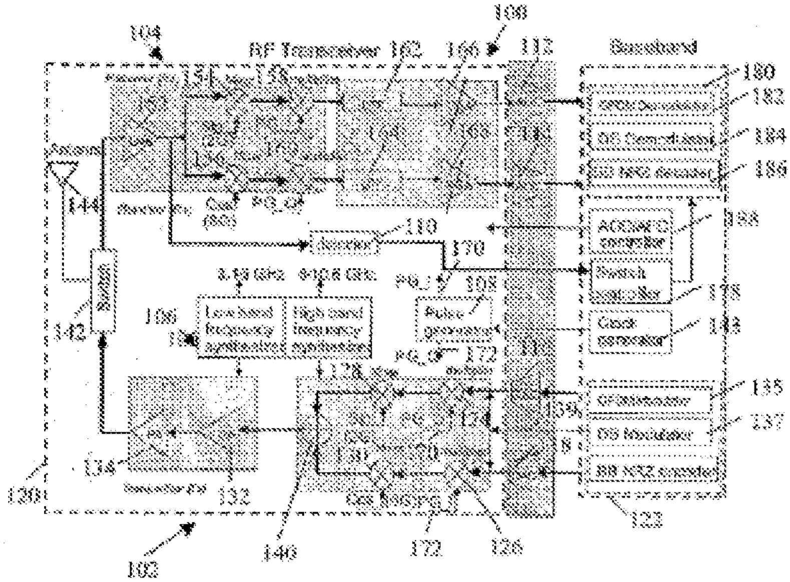
wherein the bandwidth of said low noise amplifier is greater than the difference between the lowest frequency in the first up-converted frequency range and the highest frequency in the second up-converted frequency range;

Rofougaran as modified by Zheng discloses wherein the bandwidth of said low noise amplifier (e.g., LNA 152) is greater than the difference between the lowest frequency in the first up-converted frequency range and the highest frequency in the second up-converted frequency range. Zheng ¶ [0053] (“In the receiver 150, in each band, frequency downconversion is performed first, followed by coherent correlation.”). This can be expressed as Zheng Eqs.. 4 & 5, (e.g., Zheng ¶ [0054]).

Therefore, Zheng discloses amplifying the same input signal y(t) with same LNA (i.e., using the same receiver gain B) and recovering both baseband signals. Thus, the bandwidth of the LNA 152 must be at least difference between lowest frequency in first range and highest frequency in second range, or both baseband signals could not be successfully recovered. (See Lanning Dec. ¶ 226). See also Rofougaran (hopping) as discussed in claim 10.

down-converting the amplified received up-converted signal using a first down-converter and a signal corresponding to the first RF center frequency to produce a fourth analog signal corresponding to the first analog signal; and

Rofougaran as modified by Zheng discloses down-converting the amplified received up-converted signal using a first down- converter (e.g., mixer 154) and a signal corresponding to the first RF center frequency (e.g., low-band frequency synthesizer signal 2G) to produce a fourth analog signal corresponding to the first analog signal (e.g., output of mixer 154). See Zheng, Fig. 1, mixer 154.



The output of the LNA 152 is connected in parallel to mixers 154, 156. Zheng ¶ [0029] ("The receiver 104 includes one low noise amplifier (LNA) 152, two mixers 154, 156, two multipliers 158, 160, two low pass filters (LPFs) 162, 164, and two variable gain amplifiers (VGAs) 166, 168. The LNA 152 is used to amplifier the received UWB signals from antenna 144. The mixers 154, 156 can be employed to downconvert the different band signals to the baseband. The signal after LNA 152 is a dualband/multiband signal. Since the input LO signals for the two mixers 154, 156 are different, the mixer 154, 156 output signals can be differentiated."'). Zheng ¶ [0053] ("In the receiver 150, in each band, frequency downconversion is performed first, followed by coherent correlation."), ¶ [0054] ("The baseband signals x1(t) and x2(t) are thus recovered, and are converted to a serial sequence x(t) through the parallel to sequential converter implemented in the DS Demodulator 184."). See also Zheng Eqs. 4 & 5.

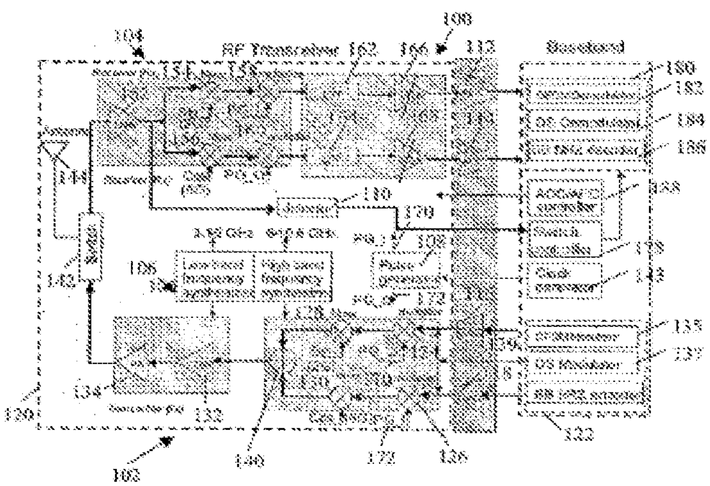
The mixers 154, 156 downconvert the amplified, received signal using two local oscillators (LOs) at frequencies 6.072 GHz and 792 MHz, which are the same frequencies used for transmitting the signal. See Zheng ¶ [0052] (describing upconverted signals and particular center frequencies and frequency ranges in the transmitter 102) ("In the described example, the

generated pulses cover a frequency range (-10 dB bandwidth) from 0.5 to 4 GHz, thus the central frequency is 2.25 GHz. To shift the central frequency to the low frequency band from 3.1 to 4.85 GHz, a 792 MHz LO can be used so that the upconverted frequency is from 1.292 to 4.792 GHz. Through pulse shaping, utilizing DA 132, the upconverted frequency can be shaped to the low band from 3.1 to 4.792 GHz (-10 dB band width). Similarly, to shift to the high band from 6.2 to 9.7 GHz, a 6.072 GHz LO can be used so that the upconverted frequency band is from 6.572 to 10.072. The LOs of 792 MHz and 6.072 GHz can be generated form the proposed frequency synthesizer architecture 200 described above with reference to FIG. 2."). As shown in at least FIG. 1, Zheng uses the same LO frequencies for downconverting the received signals.

> **down-converting the amplified received up-converted analog signal using a second down-converter and a signal corresponding to the second RF center frequency to produce a fifth analog signal corresponding to the second analog signal.**

Rofougaran as modified by Zheng discloses down-converting the amplified received up-converted signal using a second down-converter (e.g., mixer 156) and a signal corresponding to the second RF center frequency (e.g., high-band frequency synthesizer signal 6G) to produce a fifth analog signal corresponding to the second analog signal (¢.g., output of mixer 156).

See Zheng, Fig. 1, mixer 156.



The output of the LNA 152 is connected in parallel to mixers 154, 156. Zheng ¶ [0029] ("The receiver 104 includes one low noise amplifier (LNA) 152, two mixers 154, 156, two multipliers 158, 160, two low pass filters (LPFs) 162, 164, and two variable gain amplifiers (VGAs) 166, 168. The LNA 152 is used to amplifier the received UWB signals from antenna 144. The mixers 154, 156 can be employed to downconvert the different band signals to the baseband. The signal after LNA 152 is a dualband/multiband signal. Since the input LO signals for the two mixers 154, 156 are different, the mixer 154, 156 output signals can be differentiated.'"). Zheng ¶ [0053] ("In the receiver 150, in each band, frequency downconversion is performed first, followed by coherent correlation."), ¶ [0054] ("The baseband signals x1(t) and x2(t) are thus recovered, and are converted to a serial sequence x(t) through the parallel to sequential converter implemented in the DS Demodulator 184."). See also Zheng Eqs. 4 & 5.

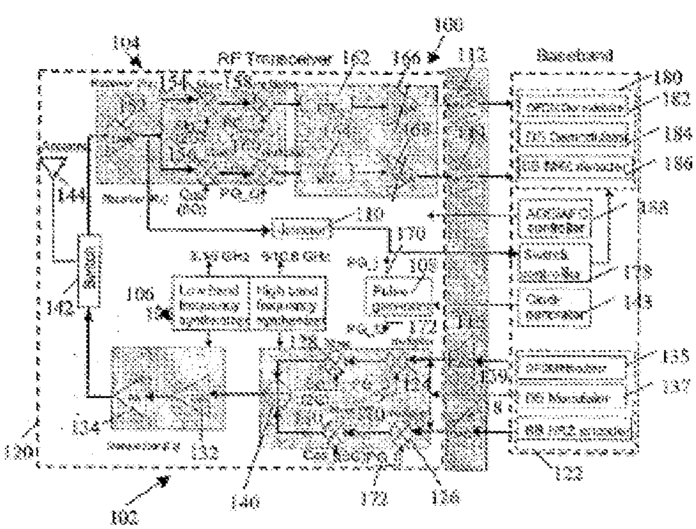
The mixers 154, 156 downconvert the amplified, received signal using two local oscillators (LOs) at frequencies 6.072 GHz and 792 MHz, which are the same frequencies used for transmitting the signal. See Zheng {| [0052] (describing upconverted signals and particular center frequencies and frequency ranges in the transmitter 102) ("In the described example, the generated pulses cover a frequency range (-10 dB bandwidth) from 0.5 to 4 GHz, thus the central frequency is 2.25 GHz. To shift the central frequency to the low frequency band from 3.1 to 4.85 GHz, a 792 MHz LO can be used so that the upconverted frequency is from 1.292 to 4.792 GHz. Through pulse shaping, utilizing DA 132, the upconverted frequency can be shaped to the low band from 3.1 to 4.792 GHz (-10 dB band width). Similarly, to shift to the high band from 6.2 to 9.7 GHz, a 6.072 GHz LO can be used so that the upconverted frequency band is from 6.572 to 10.072. The LOs of 792 MHz and 6.072 GHz can be generated form the proposed frequency synthesizer architecture 200 described above with reference to FIG. 2."). As shown at least in

FIG. 1, Zheng uses the same LO frequencies for downconverting the received signals using the mixers 154. 156. A POSITA would recognize that combining the multi-band transmitter device and method of Rofougaran (and alternatively with Jäntti, as discussed above and incorporated here) with the multi-band receiver device and method of Zheng would have the predictable results of receiving and processing the transmitted signals. Further, a POSITA would be motivated to combine the transmitter of Rofougaran with the receiver of Zheng to maximize block utility efficiency and to optimize power consumption, as disclosed by Zheng. The combination of Rofougaran with Zheng as discussed above discloses all the elements of Claim 14.

RE: Claim 15

The method of claim 12 further comprising:
Filtering the fourth analog signal using a third filter and filtering the fifth analog signal using a fourth filter; and

Zheng discloses filtering the fourth analog signal (e.g., output of mixer 154) using a third filter (e.g., LPF 162) and filtering the fifth analog signal (e.g., output of mixer 156) using a fourth filter (e.g., LPF 164). See Zheng. Fig. 1. low-pass filters (LPFs) 162. 164.



Zheng ¶ [0031] ("The LPFs 162, 164 are used to extract the desired baseband signal and reject out-of band interference. The VGAs 166, 168 each provide around 60 dB dynamic range so that their output has sufficient swing to drive the ADCs 112, 114. The bandwidth of the LPFs 162, 164 and VGAs 166, 168 should be designed as variable so that the architecture 100 can be used for different standards."). Zheng ¶ [0055] ("For each band, the LPFs 162, 164 respectively —3 dB bandwidth can be set at half of the data rate, e.g., for 500 Mbps, the LPFs 162, 164 bandwidth is 250 MHz.").

> **converting the filter fourth analog signal into a third digital signal using a first analog-to-digital converter and converting the filter fifth analog signal into a fourth digital signal using a second analog-to-digital converter; and**

Zheng discloses converting the filtered fourth analog signal (e.g., output of the LPF 162) into a third digital signal using a first analog-to-digital converter (e.g., ADC 112) and converting the filtered fifth analog signal (e.g., output of the LPF 164) into a fourth digital signal using a second analog-to- digital converter (e.g., ADC 114). See Zheng, Fig. 1, analog-to-digital converters (ADCs) 112, 114.

Zheng ¶ [0035] ("The ADC/ DACs 112, 114, 116, 118 can be employed to interface the RF transceiver 120 with the baseband processor 122. Different specifications such as sampling rate, resolution etc. are set for the different schemes."), ¶ [0057] ("In the DS-UWB scheme, the ADCs 112, 114 work on a sampling rate equal to the data rate with a resolution 2-4 bits.").

> **combining the third and fourth digital signals to receive data corresponding to the first data.**

Zheng discloses combining the third and fourth digital signals (e.g., output from the ADCs 112, 114) to receive data corresponding to the first data (e.g., baseband data processed by the demodulator 184). See Zheng, Fig. 1, DS demodulator 184.

Zheng ¶ [0054] ("The baseband signals x1(t) and x2(t) are thus recovered, and are converted to a serial sequence x(t) through the parallel to sequential converter implemented in the DS Demodulator 184."). (See Lanning Dec. ¶¶ 227- 228).

As discussed above, Rofougaran discloses a transmitter that transmits multiple signals simultaneously in distinct frequency bands; however, Rofougaran does not expressly disclose a receiver. Zheng, in an analogous field, discloses a uniform RF transceiver that performs both multi-band transmission and multi-band reception. A POSITA would recognize that combining the multi-band transmitter device and method of Rofougaran with the multi-band receiver device and method of Zheng would have the predictable results of receiving and processing the transmitted signals. Further, a POSITA would be motivated to combine the transmitter of Rofougaran with the receiver of Zheng in order to maximize block utility efficiency and to optimize power consumption, as disclosed by Zheng.

III. CONCLUSION

A. Submissions

Information Disclosure Statement (IDS)

The IDS submission on 03/26/2024 has been considered as of the Order filed 06/13/2024. It is to be noted, however, that where patents, publications, and other such items of information are submitted by a party (patent owner or requester) in compliance with the requirements of the rules, the requisite degree of consideration to be given to such information will be limited by the degree to which the party filing the information citation has explained the content and relevance of the information. In instances, where no explanation of citations (items of information) is required and none is provided for an information citation, only a cursory review of that

information is required. The examiner need only perform a cursory evaluation of each unexplained item of information, to the extent that he/she needs in order to determine whether he/she will evaluate the item further. If the cursory evaluation reveals the item not to be useful, the examiner may simply stop looking at it. This review may often take the form of considering the documents in the same manner as other documents in Office search files are considered by the Examiner while conducting a search of the prior art in a proper field of search. The initials of the Examiner, in this proceeding, placed adjacent to the citations on the PTO/SB/08A or its equivalent, without an indication in the record to the contrary in the record, do not signify that the information has been considered by the Examiner any further than to the extent noted above. The same degree of consideration was provided for the references merely cited with the request but for which no explanation regarding the content and relevance of the information was provided. See MPEP 609, Chapter 0600, pages 192-193 of pages 1-197 - MPEP Eighth Edition, Revision 8 (July 2010). The examiner notes that due to the unusually large number of referen ces cited, and the absence of any description of the relevance of the references, it should be assumed that only the most cursory review of the cited documents consistent with these guidelines has been performed. If applicant is aware of any information that might be of particular relevance, it should be pointed out in order to insure a higher degree consideration.

The responsibility of compliance with 37 CFR 1.555 rests on all such individuals. Any fraud practiced or attempted on the Office or any violation of the duty of disclosure through bad faith or intentional misconduct by any such individual results in noncompliance 37 CFR 1.555(a). This duty of disclosure is consistent with the duty placed on patent applicants by 37 CFR 1.56. Any such issues raised by the patent owner or the third party requester during a reexamination proceeding will merely be noted as unresolved questions under 37 CFR 1.552(c).

All such individuals who fail to comply with 37 CFR 1.555(a) do so at the risk of diminishing the quality and reliability of the reexamination certificate issuing from the proceeding.

See MPEP § 2282 (*ex parte* reexamination) and MPEP § 2686 (*inter partes* reexamination) for the patent owner's duty to disclose prior or concurrent proceedings in which the patent is or was involved. Patent Owner is advised to supply a copy of the pertinent areas of these references so they may be considered by the Examiner

In order to ensure full consideration of any amendments, affidavits or declarations, or other documents as evidence of patentability, such documents must be submitted in response to this Office action. Submissions after the next Office action, which is intended to be a final action, will be governed by the requirements of 37 CFR 1.116, after final rejection and 37 CFR 41.33 after appeal, which will be strictly enforced.

B. Extension of time

Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extensions of time in ex parte reexamination proceedings are provided for in 37 CFR 1.550(c). See MPEP § 2265.

C. Litigation Reminder

The patent owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving

Patent No. 7,924,802 throughout the course of this reexamination proceeding. The third party requester is also reminded of the ability to similarly apprise the Office of any such activity or proceeding throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282 and 2286.

D. Amendment in Reexamination Proceedings

Patent owner is notified that any proposed amendment to the specification and/or claims in this reexamination proceeding must comply with 37 CFR 1.530(d)-(j), must be formally presented pursuant to 37 CFR 1.530(d) - (j), and must contain any fees required by 37 CFR 1.20(c). See MPEP § 2234 and 2250(IV) for examples to assist in the preparation of proper proposed amendments in reexamination proceedings.

E. Service of Papers

All correspondence related to this ExParte reexamination proceeding should be directed:

By EFS: Registered users may submit via the electronic filing system EFS-Web, at https://efs.uspto.gov/efile/myportal/efs-registered

By Mail to: Mail Stop Ex Parte Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand: Customer Service Window
Randolph Building

401 Dulany Street
Alexandria, VA 22314

Telephone numbers for reexamination inquiries:

Reexamination and Amendment practice: (571) 272-7703

Central Reexamination Unit (CRU): (571) 272-7705

Any inquiry concerning this communication or earlier communications from the examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

/DAVID E ENGLAND/ Primary Examiner, Art Unit 3992

Conferees:

/Roland Foster/ Primary Examiner, Art Unit 3992
/MICHAEL FUELLING/
Supervisory Patent Examiner, Art Unit 3992